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AN IMPORTANT CONTRIBUTION TO AUTOMATIC FLIGHT

A device that enables aircraft to maintain a constant selected altitude can be a boon to aviation.

Such a device is the new Honeywell Altitude Control. Many times more sensitive and accurate than any other altitude control, it senses and gives usable signals for displacements of two feet at 65,000 feet of altitude. It makes possible vastly improved bombing accuracy and ease of flight.

Constant altitude, in itself and as it contributes to constant airspeeds, is a vital factor in determining bomb trajectory. With constant altitude and airspeed thus assured, the bombardier's calculations are made easier, his accuracy increased.

And in formation flying, the Altitude Control virtually eliminates control jockeying, greatly simplifying the pilot's job and delivering more miles per pound of fuel.

Unlike other controllers, the Honeywell Altitude Control gives signals for *rate of displacement* and integral control as well as for displacement. Taken together and fed into the autopilot circuit, they give unprecedented altitude control.

The remarkable new Altitude Control is another Honeywell first. And there will be others, too. Because automatic controls are essential to aviation progress. And automatic control is Honeywell's business.

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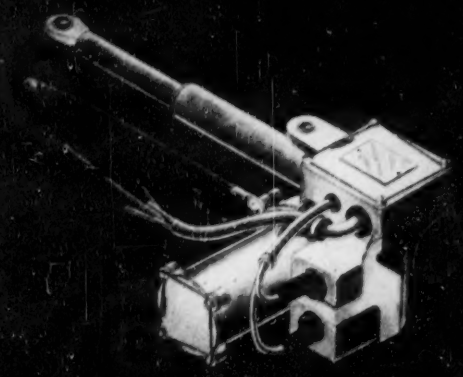
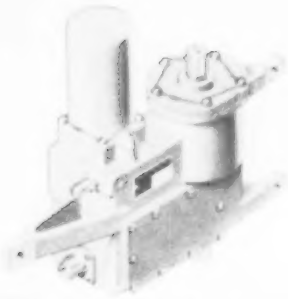
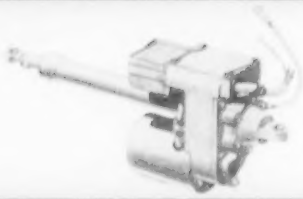


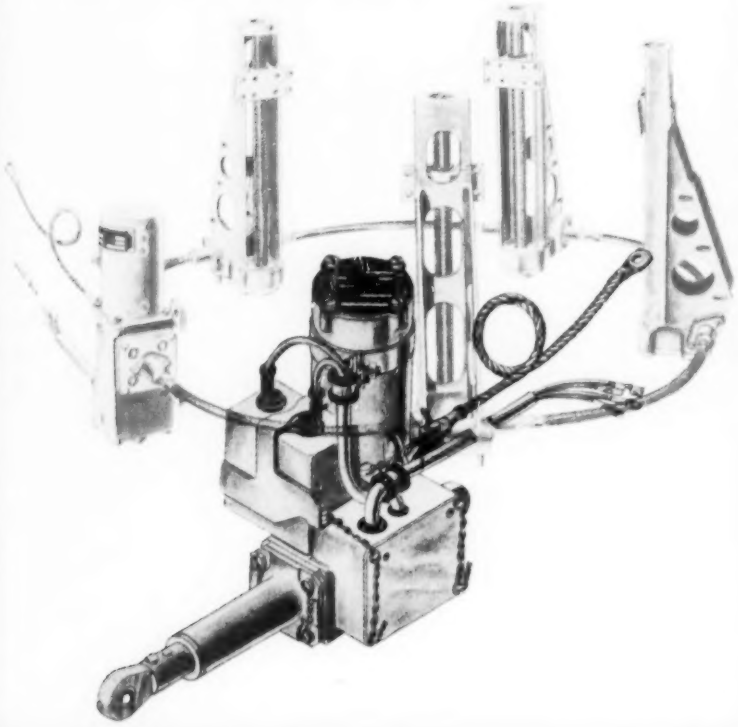


How Hydro-Aire Accentuates the Actuator



Actuators are purely personal; each application calls for an individual solution. That's why Hydro-Aire is in such an excellent position to accentuate the Actuator. In *Engineering*, few manufacturers have had wider or more varied experience. *Testing* is the responsibility of Hydro-Aire's own Research Laboratories, one of the largest in the country. *Prototypes* are speedily manufactured in Hydro-Aire's Special Order Plant. Because Fractional Horsepower *Motors* are manufactured by Hydro-Aire's own Subsidiary, they are engineered to the product—not the product to the motor. *Production* is fast and efficient—a result of Hydro-Aire's new vastly expanded facilities.

Yes, Hydro-Aire is in a splendid position to accelerate your Actuator deliveries. Write for complete information.



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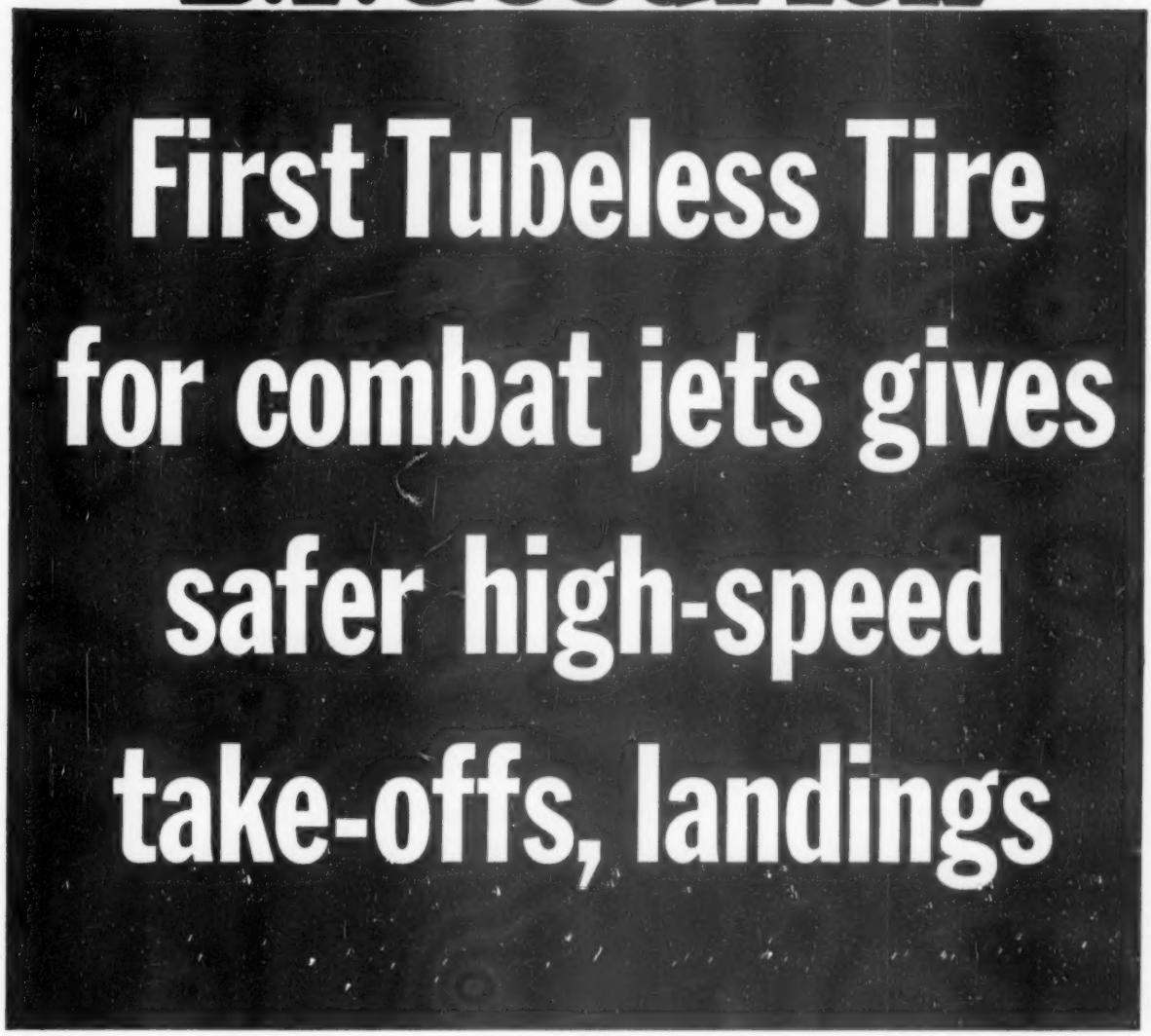

First Tubeless Tire for combat jets gives safer high-speed take-offs, landings

Proved in flight tests on Navy's Grumman Cougar

B. F. GOODRICH announces a new aeronautical advance—the world's first tubeless airplane tire for military jets. It's designed to give safer high-speed landings and take-offs, cut weight, simplify assembly and maintenance.

Like the famous B. F. Goodrich Tubeless Tire for passenger cars, introduced five years ago, the new airplane tire has a patented inner lining that's part of the tire itself. There's no tube to go flat —no tube to bunch up or shift during landings and take-offs.

Because the inner tube is eliminated, the new BFG tubeless airplane tire reduces overall weight of aircraft. Instead of the conventional unit of tire and matching tube, there's only one unit to assemble and mount. Only one unit to warehouse, too. In addition, there's less checking of inflation pressure because the special lining retains air much longer than conventional tubes. Loss of air around the rim is prevented by ridges molded on the outer side of the tire.

The new BFG tubeless airplane tire has passed the most severe laboratory tests, including a special "bottoming" test specified by the Navy. It showed the tire retains air even though compressed flat to the rim! The tire went on to pass its flight tests on the Grumman Cougar, new Navy jet fighter.

Another B. F. Goodrich first in aviation, the new high pressure tubeless tire for combat jets is the latest example of BFG's leadership in rubber research and engineering.

Send this coupon for more information about B. F. Goodrich aeronautical products. Check the items; print your name and address in the margin below (or pin to your company letterhead).

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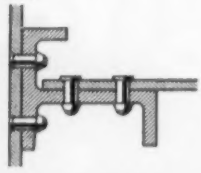

HI-SHEAR rivets simplify design and riveting problems. They are compact, require less tool clearance and have the smallest "headed ends" of any high strength fastener.

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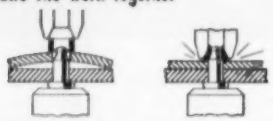
HI-SHEAR rivets are visually inspected, rapidly and accurately. When the outside of the collar is smooth and neatly trimmed the inspector KNOWS the collar fills the grooved pin end. Only HI-SHEAR trims the collar as it drives — the positive check for tool wear, correct pin length and complete driving.

draws the work together



The HI-SHEAR collar (opposing the pin head and acting as own draw set) automatically draws the work together, instantly and firmly. "Flashing" which occurs with conventional aluminum riveting is eliminated, thus reducing work spoilage.

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of our 60 page booklet "Riveting with HI-SHEARS" containing useful installation and inspection data is awaiting your request.

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Aviation Week

Volume 58 — May 4, 1953 — Number 18

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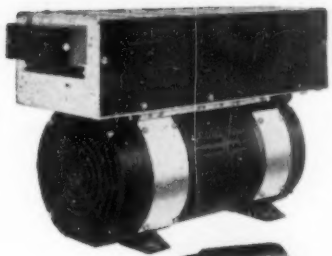

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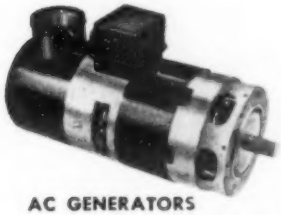

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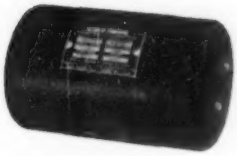
SPECIAL-PURPOSE ELECTRON TUBES



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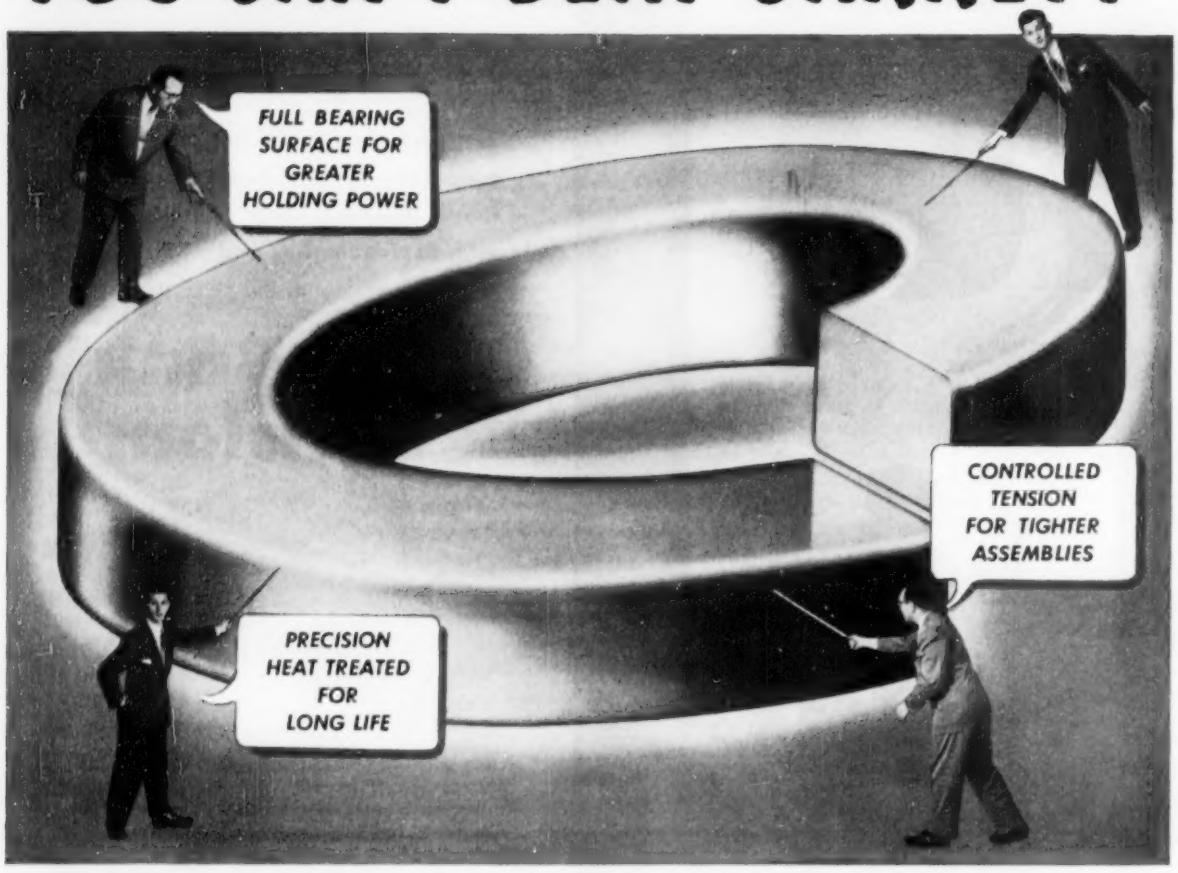
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NEWS DIGEST

Domestic

Harmar D. Denny, Jr., was designated by President Eisenhower last week as Civil Aeronautics Board vice chairman.

Robert B. Murray, Jr., Commerce Department Undersecretary, is studying recommendations of 29 carriers on how to improve Civil Aeronautics Administration and transfer some of its functions back to airline management.

Fred Billings Lee was sworn in as CAA administrator last week by Commerce Secretary Sinclair Weeks.

Delta-Chicago & Southern Air Lines merger was completed and the two companies started operating as one carrier last week.

Aviation Reform Committee of New York's Queens borough proposed last week that residents of the suburban area sue the Port of New York Authority for a total of $20 million, price tag set by the group for "air rights" over homes in the vicinity of La Guardia and Idlewild International Airports.

Navy's P7V-1 Turbo Compound Super Constellation was restricted briefly to low altitudes after exhaust gases blew into cool-air passages during recent high-altitude tests, causing turbine overheating. Solution primarily involved tighter clearances between air and gases.

First CAA-approved runway centerline approach lights are in operation at San Francisco International Airport.

Two pilots of a four-man crew survived the crash of a Seattle-bound American Air Transport C-46 in Washington's Cascade Mountains Apr. 23, 10 days after a Miami Airlines DC-3 went down in the same area and killed six.

Leslie O. Barnes, former director of operations, Air Transport Assn., is new president of Allegheny Airlines. Robert M. Love, former president, has been elected chairman of the board. Barnes joined Allegheny last February.

American Meteorological Society's award for outstanding services was presented to Harry F. Guggenheim, Port Washington, N. Y., last week for "establishing the first airways meteorological network in America."

Fiftieth anniversary of powered flight observations are scheduled to start this week in cities throughout the U.S.

BOLKO VON RICHTOFEN (right), a brother of famed World War I German ace, gets firsthand information on the Republic F-84E Thunderjet fighter-bomber from Maj. Gen. Truman Landon, Chief of Staff USAF-Europe (far left) during a recent visit to an American air base. Von Richtofen was one of a group of 28 Germans, including World War II Luftwaffe officials, invited to inspect U. S. facilities at Landstuhl.

Harry J. Garman, 47, veteran American Airlines pilot, died Apr. 22 at Ft. Worth, Tex.

Financial

United Aircraft Corp., East Hartford, Conn., estimates that shipments made during the first quarter of 1953 totaled $200 million, indicating common stock earnings of $1.75 per share. UAC shipments for the same period last year were $145 million, or earnings of $1.07.

Trans World Airlines has made a $2.4-million sinking fund and interest payment deposit on loans from the Equitable Life Assurance Society, reducing the original $40 million due to $24,280,000.

American Car & Foundry Co., New York, has purchased the entire capital stock of Avion Instrument Corp., Paramus, N. J., producer of electronic systems.

Colonial Airlines profits for the first quarter of 1953 total $14,000, compared with a $259,000 loss for the first three months of last year. Profits for the 12-month period that ended Mar. 31, 1953, add up to $86,000.

Northwest Airlines ended the first quarter of this year with a net loss of $687,601, compared with a loss of $1,208,547 for the same period of 1952. Operating revenues total an all-time high of $12,143,786, topping $10,588,501 reported for the first quarter of 1952.

California Eastern Airways, Oakland, Calif., reports a net income for 1952 of $250,382, nearly double the 1951 total of $134,284.

Air Express Division, Railway Express Agency, reports gross revenues last year totaling $32,364,803, a gain of $1,689,530 over 1951 revenues of $30,675,272.

Fairchild Engine & Airplane Corp., Hagerstown, Md., has declared a dividend of 20 cents per common share.

Delta Air Lines directors have voted a 25-cent quarterly dividend to stockholders of record as of May 15.

International

Jet transports will be limited to subsonic speeds of 500-600 mph. for some years to come, because high fuel consumption would outweigh any commercial advantages, says Sir Frederick Handley Page, chairman of Handley Page, Ltd.

British European Airways has grounded its 27-plane tourist fleet of Vickers Vikings (Admirals) because seats were working loose from cabin decks.

Canadian Defense Minister Brooke Claxton says his country will spend $77 million this year for production of the CF-100 twin-jet fighter and $65 million for the F-86E.

Read about it in Aviation Week SEE it at the

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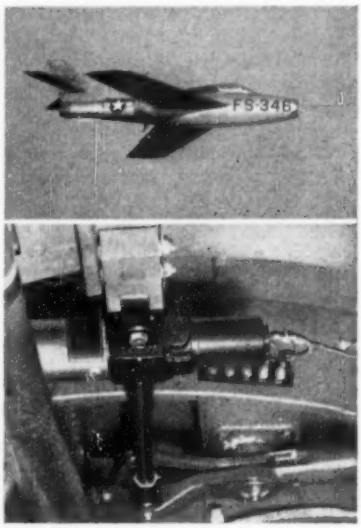
Rudder Trim System on Republic's F84F

Airborne actuated



The R-244-M14 LINEATOR® Electric Linear Actuator is specified equipment on Republic's new sweptwing F84F Thunderstreak. This actuator features radio noise filter, neutral light switch, positive mechanical stops, and externally adjustable position limit switches.

For complete information about LINEATORs and other Airborne electromechanical actuators, see our literature in the Institute of the Aeronautical Sciences 1953 Engineering Catalog.

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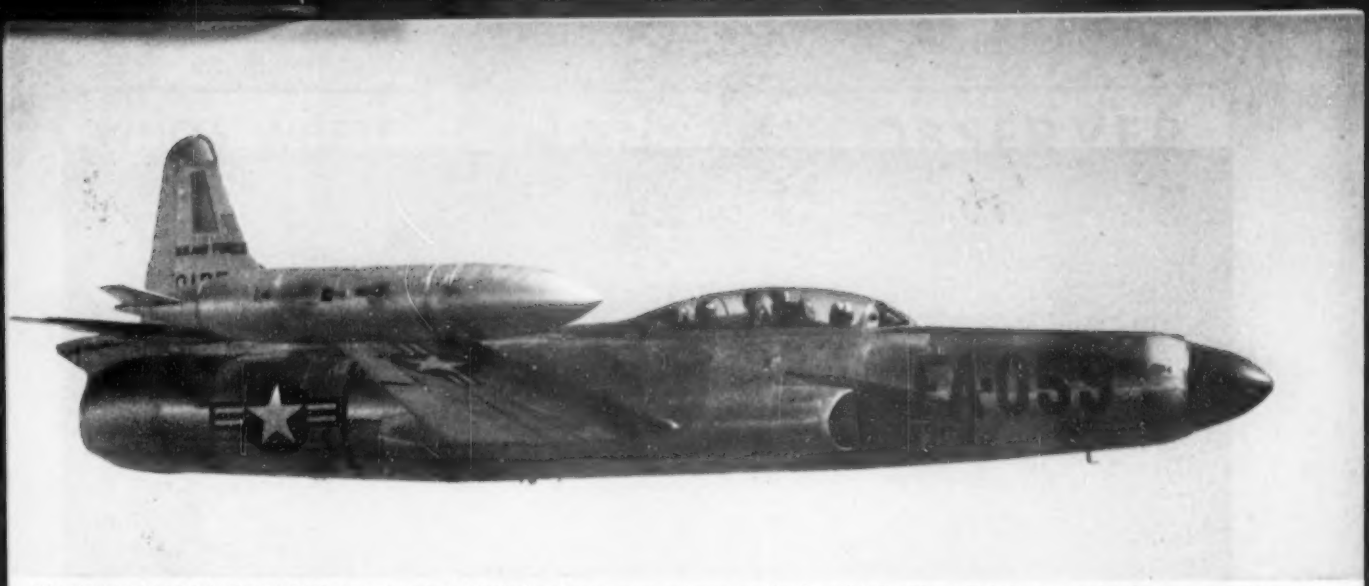
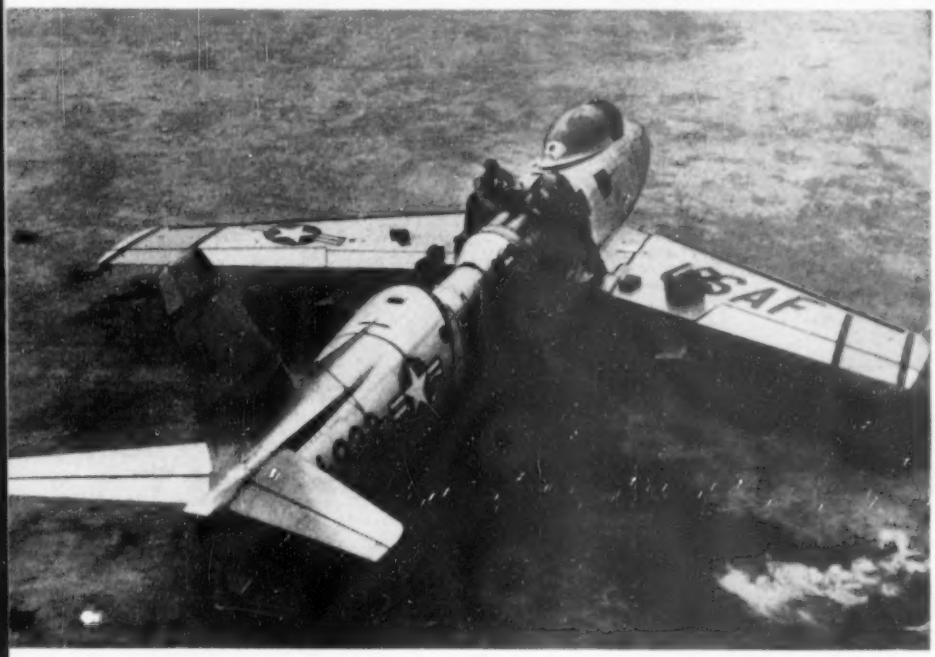


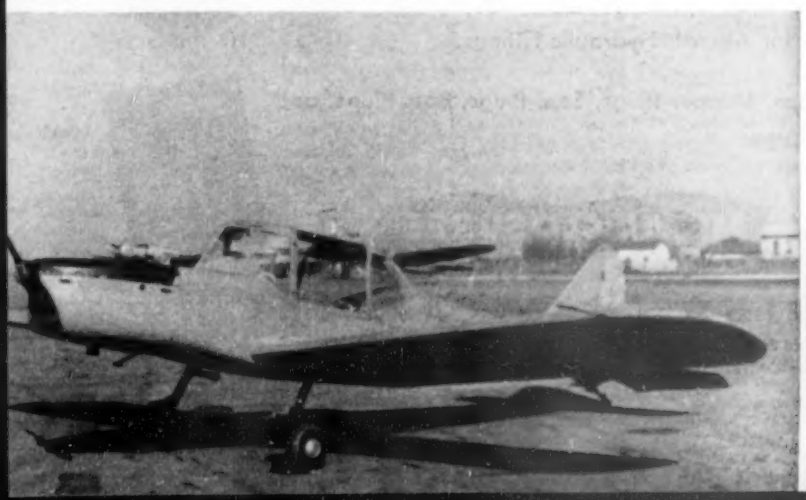
STARFIRE SPORTS NEW NOSE—A pointed elliptically shaped nose radome, as fitted to this Lockheed F-94C, has replaced the rounded version fitted on earlier Starfires (Aviation Week Apr. 27, p. 18). Lockheed engineers developed the new configuration after 18 months research.



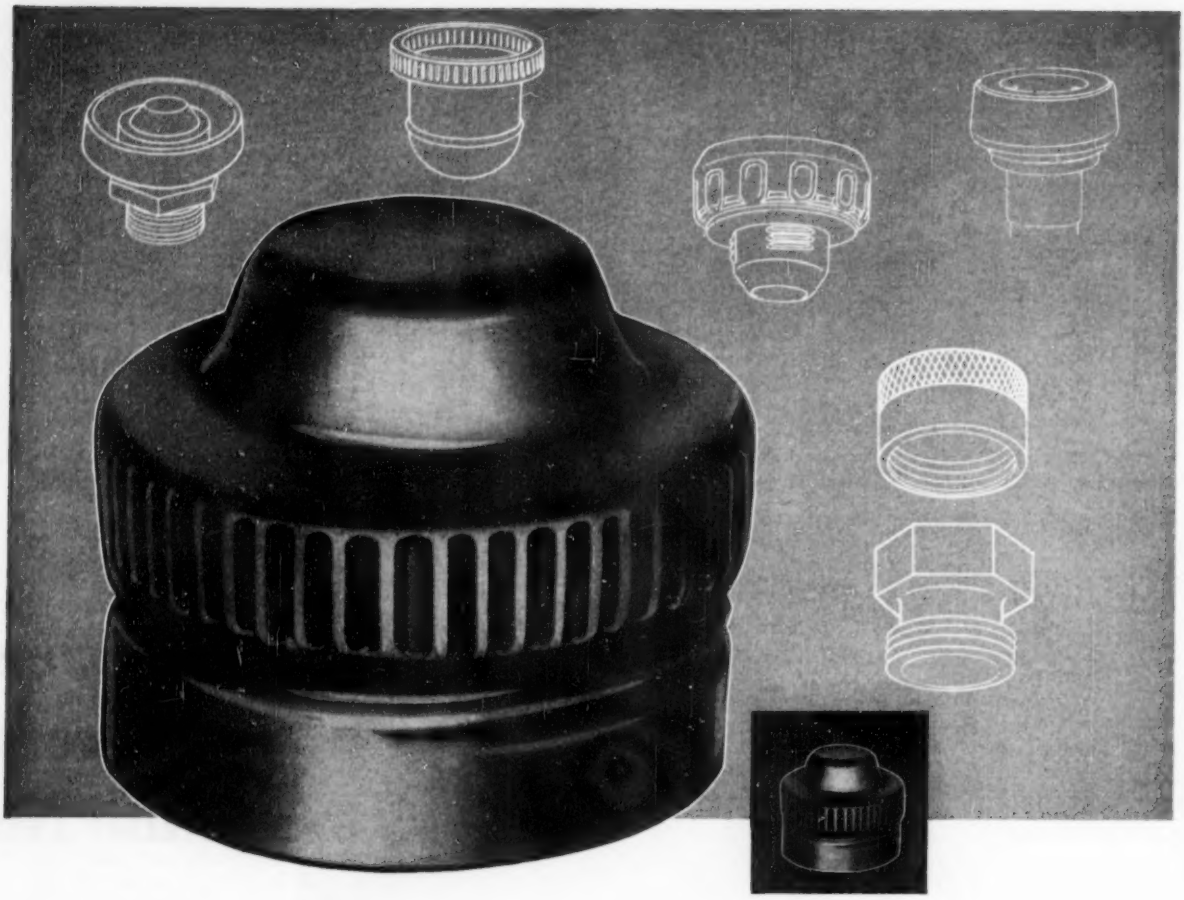
New Views Of Aircraft In the News

BATTLEGROUND OVERHAUL—An F-86 Sabre of the 4th Fighter Interceptor Wing gets a new General Electric J47 engine at a forward air base somewhere in Korea. Splitting the fuselage behind the swept wings simplifies combat maintenance.

ITALIAN LIGHTPLANE TESTED—Musca 1 Ter (below) is a two-place all-wood personal plane powered by a 75-hp. Walter Mikron engine. Top speed is 124 mph. The craft has an empty weight of 748 lb. and grosses 1,320 lb.



PANTHER HUDDLE—Four Marine Grumman F9F-4 Panthers (Allison J33) VMF-314 flew 2,403.9 hr. in one month on recent Caribbean area maneuvers.



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WHO'S WHERE

In the Front Office

O. R. (Ted) Haueter, Continental Air Lines vice president-operations, is the carrier's new vice-president-maintenance, engineering and operations, taking over the additional duties of **Harry C. Short,** who resigned recently.

C. Hart Miller, former president and general manager of Piasecki Helicopter Corp., has been elected a director of Prewitt Aircraft Co., Clifton Heights, Pa.

C. W. Nelson, secretary-treasurer of Pacific Northern Airlines, and **Paul Porzelt,** New York broker, are new directors of PNA.

Promotions

Robert H. Estabrook, three-time winner of the Trans World Airlines aviation writer award, has been named editor of the Washington (D. C.) Post editorial page.

D. T. Fisher has been elected controller and **G. T. Bovee** has been promoted to treasurer of Consolidated Vultee Aircraft Corp., San Diego, Calif.

Karl W. Dahlem has been appointed public relations director of American Airlines, succeeding **Joseph D. Ryle,** who resigned to become executive vice president of the Federation for Railway Progress.

Harvard C. Waken has been elected treasurer of Bardwell & McAlister, Inc., Burbank, Calif. Other promotions: **Robert D. Hallock,** plant manager, and **Paul Winkler,** sales manager of the organization's Rosan Division.

Lloyd Kelly has been named general sales manager of Link Aviation, Inc., Binghamton, N. Y. **Gene Bond** has been appointed Washington (D. C.) district manager, and **A. E. Williams** is new government sales manager.

Robert M. Barry has been named assistant director of contract administration for Boeing Airplane Co., Wichita. Boeing has made these appointments in the new Pilotless Aircraft Division: **Richard Nelson,** production manager; **R. E. Bothell,** assistant manufacturing manager; **Lewis Daniels,** process coordinator; **Rex Delaware,** factory shops superintendent, and **Clyde Peterson,** tooling manager.

Changes

Lt. Col. John P. Stapp, who recently received an IAS award for research on the effect of aircraft crashes on the human body, has been named chief of the AF Space Biology Laboratory, Holloman Air Development Center, Alamogordo, N. M.

Maj. Joseph Egy (AF Ret.) has joined Gavco Corp., New York, to supervise development of voltage and frequency controls.

W. R. Hedeman is new electronics project engineer in guided missile development at Chance Vought Aircraft Division, United Aircraft Corp., Dallas.

James J. Haggerty, Jr. has resigned as military editor of American Aviation.

INDUSTRY OBSERVER

► Republic Aviation is conducting a market survey to determine industry interest in a twin-jet executive-type transport capable of cruising at 500 mph. It would carry up to 16 passengers, be pressurized for operation to 45,000 ft., and sell for under $1 million. Present design thinking is based on using J65 (Sapphire) engines, but Republic also is reported to be considering General Electric J47s.

► Westinghouse J46 turbojet has made its first flight powering a Chance Vought F7U-3 Cutlass. The J46 is scheduled to replace the Allison J35 now being used in early model Cutlasses and the J34 now being used in the Convair XF2Y-1 hydroski fighter. Both the Cutlass and Sea Dart will have twin J46 installations.

► Vought has received a Navy letter of intent to build an undisclosed number of A2U attack versions of the Cutlass (AVIATION WEEK Nov. 10, 1952, p. 11 and Apr. 20, 1952, p. 11). The A2U will be powered by a pair of J46 jets and will be used by Navy carrier air groups and Marine shore-based squadrons.

► Sabena Belgian Airlines shortly will purchase three Sikorsky S-55 10-place helicopters for use on an international helicopter passenger and mail service linking Brussels, The Hague, Rotterdam and Lille.

► Avionics industry is moving rapidly to investigate an antimony-aluminum compound developed by the Battelle Memorial Institute as a substitute for germanium now used in transistors and rectifiers. Bell Telephone Laboratories already have obtained antimony from the Bradley Mining Co. of San Francisco, owner of a major U. S. antimony mine and refinery and sponsor of the Battelle investigation. RCA, Hughes Aircraft, Sylvania and Clevite also have approached Bradley for antimony.

► Several major airlines are considering installation of magnetic tape playback units to provide inflight background music for passengers. A small unit specifically designed for airline use with a two-hour tape supply will shortly be marketed by Ampex Electric Co. of Redwood City, Calif.

► A Russian night fighter group equipped with new twin-jet aircraft provisionally designated the MiG-17 is now operating out of Merseberg Airdrome near Halle in the Eastern Zone of Germany. The new fighters resemble the MiG-15 in general configuration but are powered by two jets housed under the fuselage with tailpipes ending just under the trailing edge of the wing. The MiG-17s are hangared during the day, operate only at night, and are back behind closed hangar doors before daylight.

► Bristol Aeroplane Co. has a 45-passenger jet helicopter project (H.66) on the drawing board. The H.66 will have stub wings and feature two turbojets plus ramjets on the rotor tips.

► Redux metal bonding process passed a rugged test in the recent Karachi Comet crash. Inspection of the Comet wreckage indicated that Reduxed parts stood up well in the explosion that followed the takeoff crash. Comet parts are being shipped back to England for further technical inspection.

► British helicopter industry is getting little support from the military services. Orders for only 20 military helicopters—10 for Navy and 10 for the RAF—are now on British books. First British squadron of operational military helicopters was made up of Sikorsky H-19s obtained under the Mutual Security program and is now in service against the Communists in Malaya.

► Vickers Viscount has completed its cold-weather trials in Canada for Trans-Canada Air Lines and returned across the North Atlantic to England, thus becoming the first turboprop-powered aircraft to make a successful trans-Atlantic roundtrip.

Washington Roundup

Defense Budget

Defense Department budget has been submitted to the National Security Council for study and final decision before submission to Congress early this month. Actually, Defense Department submitted several budgets based on the variable prospects for peace, cold or hot war, and is leaving final decision to the Security Council.

For example, USAF portion of the budget included three alternate plans: one to continue the present 143-wing program; another with a 115-wing program featuring heavy cuts in transports and troop carrier groups, and a third with a bare minimum of 106 groups about evenly split between Strategic Air Command and Air Defense Command with tactical air eliminated and military air transport cut to the bone.

Industrial Policy

White House sources indicate there will be no fundamental policy change to narrow the base of industrial mobilization and defense production, but there will be some reduction in areas where the military has overestimated its requirements and extremely high-cost producers are causing an unnecessary economic drain. Basically the Marshall-Lovett policy of building a broad industrial base for defense requirements capable of meeting full mobilization requirements will be accepted by the Eisenhower Administration, but Defense Secretary Wilson will be given authority to trim fat off its edges.

NATO vs. Air Guard

A political storm is brewing because USAF allegedly is supplying NATO with modern aircraft at the expense of the Air National Guard. National Guard units which are now returning from federal service—some of them from Korea and Europe—are being re-equipped with F-51 piston-powered fighters because all available jet aircraft are being siphoned off to NATO countries. Reports from Europe indicate many NATO countries have more U.S. jet planes than they have qualified pilots and are not supplying pilot training quotas allocated them in USAF schools.

Meanwhile, ANG pilots, most of whom flew jets during their federal service, are being pushed back onto obsolete piston fighters. USAF has supplied about 1,200 Republic F-84 jet fighters to European countries and is now shipping Thunderjets to Chinese forces on Formosa. Large number of Lockheed T-33 jet trainers also have been shipped abroad, but ANG pilots are now forced to use the T-6 trainer of World War II vintage.

Question being raised by politically powerful ANG supporters: Does it make sense to have American-built jet fighters stand idle on European fields when experienced, combat-seasoned USAF pilots now in the ANG are forced to fly obsolete piston fighters and trainers?

Atomic Air Strategy

Basic NATO strategy for the defense of Western Europe is based on the use of air power delivering "baby" atomic bombs against Russian ground forces, according to Gen. Alfred M. Gruenther, chief of staff of SHAPE. Gen. Gruenther told the Senate Foreign Relations Committee that NATO expects to use its ground forces only to force the Russians to concentrate their ground troops sufficiently to offer good targets for tactical A-bombs.

USAF already has said the F-84G, standard NATO fighter-bomber, is equipped to deliver a tactical atomic bomb. Navy also has several carrier-based aircraft, including the McDonnell Banshee (F2H-2B) and the Douglas Skyraider (AD-4B), equipped for the same job.

Growing Red Threat

Gen. Gruenther also testified that Russian strength is increasing both in the air and on the ground. He said the Russians are modernizing their air force and the effectiveness of their 170-division land force has increased considerably during the past few years. He said the Russians now have 100 major airfields in Eastern Europe with 200 satellite fields. This compares with 40 NATO fields now operational and 60 more planned for completion during the next 18 months.

Symington Warning

This warning followed shortly on the heels of another blast by Sen. Stuart Symington, former USAF Secretary, who told the American Society of Newspaper Editors that Russia has increased its lead over the United States during the past three years in submarine, aircraft and ground forces.

Symington said the Russians now have more jet bombers than the United States, and more jet fighters "of superb technical quality" than all the United Nations now possess, and warned that all evidence pointed to the Russians continuing to increase their lead in aircraft and at the same time approaching parity in stockpiles of atomic weapons.

Comet Problem

British are now maneuvering to get the question of airworthiness certification for the Comet 3 jet transport removed from the Civil Aeronautics Administration-Air Registration Board technical level and handled on a diplomatic non-technical level between the British Foreign Office and the U.S. State Department.

Balboa Case Stymied

The New York-South American route interchange (Balboa service) case is still gathering dust at the White House with Panagra, Pan American and Eastern Air Lines all seeking a reversal of the CAB ruling. The Board denied the interchange agreement on ground that it would unite three strong carriers against two smaller lines—National and Braniff. The dossier, which requires presidential approval, has been in the White House for more than a year—under both Truman and Eisenhower.

Aircoach Promotion

Port of Oakland gives credit to CAB member Joseph Adams for helping to swing a close municipal vote approving a $10-million bond issue to improve its airport. Five days before the vote Adams made a rousing speech boosting the expansion of air travel through low-fare aircoach service that made headlines in the local papers.

—Washington staff

AVIATION WEEK VOL. 58, NO. 18
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Senators to Probe Military Plane Buying

- **Procurement faces close scrutiny in Congress.**
- **New committee may urge faster air power buildup.**

By Katherine Johnsen

A five-man subcommittee of the Senate Armed Services Committee has been quietly organized to launch a sweeping investigation of the aircraft programs of all the services.

Headed by Sen. Styles Bridges, the group includes Republican Sens. Ralph Flanders and James Duff and Democratic Sens. Harry Flood Byrd and Stuart Symington, former Secretary of the Air Force.

The Bridges subcommittee is an outgrowth of a three-man group—Bridges, Flanders, Byrd—appointed earlier to look into the letting of a C-119 contract to Kaiser-Frazer Corp. for production at Willow Run.

Unit cost on production of the cargo transport at the Hagerstown plant of Fairchild Engine and Airplane Corp., which developed it, is only $265,000, Bridges pointed out, compared with a cost of $1.2 million for the first C-119s produced at Willow Run.

Bridges questioned the advisability of incurring high costs in opening second and third production sources. Off to a slow start, this investigation still is underway.

▶**Air Power Aspect**—The enlarged investigating subcommittee has not yet charted its course in detail. But, in addition to investigating such standard subjects as inefficiency, waste, and duplication in procurement, it is expected to probe for the answers to air power aspects of these questions raised in mid-March by Senate Minority Leader Lyndon Johnson:

- "Does an aggressor nation have the planes and weapons with which the U. S. can be attacked at any and every point?
- "Does an aggressor nation have a stockpile of atomic bombs that could be used to strike at every American city?
- "Do we have a defensive force adequate to beat off an attack?
- "Do we have a force that could deliver devastating counter-blows against any enemy or have we placed our faith in equipment that is obsolete?

Sen. Styles Bridges

Sen. Ralph E. Flanders

Sen. Stuart Symington

Sen. Harry Byrd

- "Is our military force large enough to keep pace with the buildup of the aggressor, or should we be building more?"

The new subcommittee is likely to fill a role similar to that of Johnson's Preparedness Investigating Subcommittee of the last Congress, which prodded the Administration for a speedier buildup of air power and blasted the "butter instead of guns" thinking that settled in Washington with the stalemate in Korean fighting.

Symington repeatedly has posed questions similar to Johnson's in public speeches throughout the past two months. With his background, overriding interest in defense, and the strong support and guidance of political veteran Johnson, Symington is likely to emerge as a key member of the new subcommittee.

Johnson-Symington teamwork dates back many years. It was Johnson, then a senior member of the House Armed Services Committee, who picked up the case of Symington, then USAF Secretary, for a 70-group USAF program in 1949 and succeeded in selling it to the committee's chairman, Rep. Carl Vin-

Sen. James F. Duff

son. The result: Despite Senate opposition, Vinson and Johnson succeeded in getting congressional approval of the program. Later, Symington, as chairman of the National Security Resources Board, and Johnson, as chairman of the Preparedness Investigating Subcommittee, worked closely to push strategic metals programs. Johnson's influence undoubtedly was a factor in the appointment of Symington to the new investigating subcommittee.

Other members of the new group have divergent interests likely to detract from their concentration on the aircraft investigation:

• **Bridges** is chairman of the Appropriations Committee, a time-consuming job, and President Pro Tem of the Senate. He sees eye-to-eye with Johnson and Symington on the importance of air power and undoubtedly will keep his hands on the steering wheel of the new subcommittee. He was a member of the Johnson preparedness group, concurring in its recommendations. He opposed slashes in USAF funds for procurement, research and development, and operations last year.

• **Flanders,** a former business executive and banker, has specialized in economic matters on Capitol Hill, actively participating in the affairs of the Finance Committee and Joint Economic Committee. He's followed the line that a sound economy is the best defense. Flanders voted last year for all proposals for cuts in USAF appropriations.

• **Duff,** a newcomer to the Armed Services Committee this year, hasn't participated in defense matters and will need orientation in his new role as a member of the Aircraft Investigating Subcommittee. He's been active on the Small Business Committee, which has pushed for more military contracting and subcontracting.

• **Byrd's** activities as chairman of the Committee on Non-Essential Federal Expenditures, senior member of the tax-determining Finance Committee, and leader of southern political forces, occupy much of his time. His main interest is in the money side of the defense picture.

▶ **Presidential Approval**—Establishment of the Investigating Subcommittee appears to be a victory for Minority Leader Johnson. At the time Johnson raised his questions on the adequacy of U. S. defense—when it was well known that Defense Department was considering a $16-billion program for air defense, he urged the appointment of such a group.

Chairman Leverett Saltonstall of the Armed Services Committee put the matter to President Eisenhower: "Recent statements . . . indicate that there is concern, either that our defense program is inadequate, or that it has not been pushed vigorously enough, or that it is poorly oriented." Saltonstall expressed doubt about setting up a congressional investigating committee and proceeding "on a unilateral basis" to determine the adequacy of the U. S. defense position.

The President's reply discouraged this, pointing out that the National Security Council is reviewing the status of the nation's defense.

"I am encouraged," Eisenhower wrote Saltonstall, "by your statement that you do not desire to move unilaterally into this delicate field at this time, while this process of re-examination and re-analysis is still in progress." Congress' determination to assure that the defense program is soundly conceived and administered, the President commented, "is shared by the Executive Branch."

Boeing Jet Transport To Cost $4 Million

Boeing Airplane Co.'s first commercial jet transport will be ready for airline operation by late 1957, two company officials forecast.

James W. Barton, chief cost accountant, and sales director Ralph L. Bell estimate the selling price of Boeing's four-jet, sweptwing airliner at $4 million.

However, Barton says Boeing is making an effort to cut transport prices by "finding the causes for increased cost and determining basic principles which will result in lower cost when carried through into the experimental production phases."

Bell revealed only these details:

• **Operating costs** will be "in the same ball park" as current piston-powered transports.

• **Structural and aerodynamic** philosophy of Boeing's medium and heavy jet bombers will be embodied into the new airliner.

Bell says the prototype will be completed and test flown at the Boeing plant in Seattle late in the summer of next year.

▶ **Carrier Competition**—Both Barton and Bell say U. S. carriers are not ready yet to invest in turbine-powered transports because "airlines aren't sure themselves what they want in a jet." (Pan American World Airways has ordered three de Havilland Comet 3s, and Eastern Air Lines president Eddie Rickenbacker tried unsuccessfully last year to get early delivery of the British plane.)

"We don't think any airlines want to get into jets until they are forced by competition," the Boeing officials say.

▶ **Cost per Pound**—Based on the Boeing transport's planned speed of more than 500 mph., its inflation-adjusted price will be 26% less per pound than that of aircraft 20 years ago, Barton says.

"The price we have developed for the jet transport converts to 11.5 cents per pound of weight empty per mile per hour versus more than 15 cents per pound per mile per hour in 1933," he says. "That is a reduction of 26% in terms of price based on speed capability."

▶ **Economy Program**—Barton calls Boeing's economy program—outlined in his report at the Society of Automotive Engineers national aeronautical meeting in New York—an answer to charges by William Littlewood, American Airlines vice president-engineering, that estimated price tags for U. S. jet transports "do not smack of reality or of any real desire to do the job" (Aviation Week Dec. 22, p. 17).

Boeing's chief cost accountant says the program includes:

• **Increased testing** to insure designs will not progress too far before their structural and aerodynamic soundness is proved.

• **Production and tool planning** to decrease both recurring and non-recurring costs.

• **Monitoring production suppliers** to insure on-schedule and low-cost performance.

• **Finding new quality control** and inspection procedures to improve efficiency.

• **Training personnel** to increase production skills.

• **Setting cost targets.**

Barton also says airlines could cut costs of jet transports by following a "six-point prescription":

• Minimize changes from basic specifications.

• Eliminate all but the most minor variations.

• Cut use of unproved equipment.

• Reduce luxury accommodations.

• Pool purchases of aircraft and spares.

• Order spares early enough to permit concurrent production with planes.

New Air Policy

- **Defense Undersecretary outlines Wilson plan.**
- **Also hits 'unrealistic' mobilization schemes.**

By Robert Hotz

Assurance that the aircraft industry will be maintained in a healthy state and not allowed to deteriorate as it did after World War II was given last week by Undersecretary of Defense Roger M. Kyes in the first major policy speech by a key member of the Republican defense team headed by Defense Secretary Charles E. Wilson.

Kyes' assurance to the industry came in the course of a speech to the U. S. Chamber of Commerce in which he:

- **Outlined the first rough blueprint** of Wilson's approach to solving defense problems.
- **Delivered a blistering attack** on the military leadership's handling of post-Korean production expansion, labeling it as "unrealistic requirements, poor planning and inefficient execution."

Basic points in Wilson's current approach to defense problems, as outlined by Kyes include:

- **Sweeping review** of military planning and the current industrial mobilization base.
- **Revision of outmoded** and inefficient military procurement policies and practices.
- **Elimination of high-cost producers** from the defense production program.
- **Developing a stronger** civilian management team with practical business experience to ride herd on "unrealistic" military planners.

Commenting on the aircraft industry, Kyes said:

"It is important that we give careful consideration to maintaining, insofar as it can be practically achieved, the health of industries particularly vital to national defense which do not have full opportunity to share in civilian production. The aircraft industry is an example of this type.

"We must avoid for them and for the good of the nation . . . a shutdown such as they experienced after World War II. A careful projection of requirements over a period of time and close cooperation between industry and the Defense Department will be necessary to achieve this result."

▶ **Critical of Military**—Kyes was bitterly critical of military planning during the Korean crisis.

"Men of industry remember well the exaggerated figures for requirements and the unrealistic schedules with which they were confronted by the military. Planning, tools, equipment and facilities were to be based on these theoretical programs.

Roger M. Kyes

"With this onrush of orders came the drive for an industrial mobilization base founded upon the same theoretical calculations. Industry turned to the task of doing its best to meet the production targets set by the military.

"Then came the period of so-called cutbacks, 'stretchouts' and program changes which had the effect of bringing the unrealistic planning closer to the possibility of realistic accomplishment. Fantastic paper targets crumbled before the realities of the situation. Even today there are huge sums of money obligated to be spent for items which have not yet been fabricated nor will they be for some time.

"Unrealistic requirements, poor planning and inefficient execution all combined within the short span of time to cause waste of money, poor utilization of manpower, unnecessary drain of materials from the civilian economy and the inefficient use of tools, manpower, equipment and facilities.

"Then, too, when dollars became abundant the military, after slim years, refilled its storehouses and installations with many items more easily procured but not vital to security. For example, I question the combat capabilities of a year's surplus supply of calculating machines."

▶ **Cites Military Waste**—Kyes emphasized that the training of military leaders inevitably results in an unrealistic approach to logistical and procurement planning. He said that American industry had produced and delivered twice as much military materiel to Europe as was consumed by the military forces in that theater in World War II. He said one recent military mobilization plan called for hard goods production valued at $530 billion when total U. S. hard goods production for 1952 was only $78 billion. To fulfill this military plan would have taken the total capacity of American industry six years, according to Kyes.

▶ **Base Policy**—Kyes indicated that there would be no sweeping elimination of second sources in reviewing the industrial mobilization base. He stressed the importance of keeping pilot lines of defense production operating in many facilities after peak production requirements had been fulfilled. He indicated that the revision of the industrial mobilization base will be a selective process aimed at weeding out high-cost producers and producers of items for which the military had established excessive requirements and bolstering areas where requirements had been underestimated and more production capacity was required.

He listed six requirements for organizations to be included in the revised industrial mobilization base:

- **It is essential** that the organization have the management and technical knowledge required to efficiently and successfully accomplish the production task to be assigned.
- **It must have** available facilities and equipment, or by reasonable addition to existing facilities have the capacity required both as regards quality and adequacy.
- **It should be sufficiently well financed** so that it will need only to supplement its capital and not expect to rely completely on the various forms of government assistance.
- **There must be a sufficient reservoir** of manpower with the ability and skill required for efficient production.
- **Based on the nature of the equipment** to be produced, no facility should be established which falls below the requirements of a minimum economic production unit.
- **An organization** should not be given more defense business than it can handle efficiently. It is a generally accepted principle, depending upon the type of business, that a company cannot assimilate more than three or four times its civilian dollar volume in military production.

Kyes also indicated that all of the previous surveys and studies of the Defense Department have failed to solve any basic problems of the Pentagon and "have perhaps only added to the confusion."

C&S Reports Top Salary

Sidney A. Stewart, president of Chicago & Southern Air Lines, Memphis, Tenn., received $36,583 salary and $2,690 in additional payments during 1952, the airline reported to Securities & Exchange Commission this week.

Congress Fights Airport Cuts

Republicans and Democrats challenge Administration plans to hold up airfield aid pending study of program.

The tempest on Capitol Hill over the Eisenhower Administration's plan to cut $30 million from the fiscal 1954 budget for new airport development is growing, and stormy showdowns seem to lie ahead before the issue is decided.

The Administration is setting up a commission to study all grants-in-aid programs and formulate policy on federal assistance to state and local governments. It wants any decision on the airport program postponed until this is accomplished.

Both Republicans and Democrats in Congress are angrily challenging this course. They feel it may be years before a federal-state relations policy can be worked out successfully and that, in the meantime, airport development should go on.

Pressure on Congress is heavy from local governments with fiscal 1953 projects affected by the Budget Bureau's freeze order, as well as cities that have raised a total of $75 million in matching funds for airport development. Of the approximately 170 projects blueprinted by Civil Aeronautics Administration for $11 million total spending in current fiscal year, 63 totalling $5.5 million have been unfrozen so far.

A plan to hold off local pressure on Congress by not revealing in detail where the $30 million would be spent has failed (see p. 23).

The current outlook:

• **House Appropriations Committee** has followed Administration's recommendation, striking out the $30 million for airports in the Commerce appropriation bill. But a showdown on the floor is likely when it comes up for debate this week.

• **Senate Appropriations Committee** is expected to allow at least some of the $30 million so airport development can continue during the coming year.

Meanwhile, yielding to congressional pressure, Undersecretary of Commerce for Transportation Robert Murray is considering speeding up the review and asking Congress for a supplemental appropriation for airports in the middle of fiscal 1954 (beginning of calendar 1954).

New CAA administrator Fred Lee is in the middle of the Administration-Congress fight. As acting administrator, Lee supported the $30 million (a sharp increase over the $14.3 million provided for airport development for fiscal 1953) in testimony last March before the House Appropriations Committee.

"The expansion that has and will take place in both military and civil aviation," he testified, "and the newer, faster, heavier and more diversified aircraft require that funds . . . be increased to avoid having deficiencies in services become deterrents to the use and development of U. S. air power."

As a result, Lee took the brunt of congressional criticism of the Administration's decision to cut out new airport money. For a time, this criticism delayed his approval as administrator by the Senate Interstate and Foreign Commerce Committee.

Congressional interest in the issue was demonstrated when 14 of Senate Commerce Committee's 15 members turned out for Lee's confirmation hearing, largely to question the airport cut.

Here are some of the developments at the Commerce Committee session and at Appropriations Committee's session on CAA's budget:

• **Senators sharply challenged** the Administration's prerogative to call off airport development, pointing out that Congress has passed legislation authorizing a $520-million program extending through fiscal 1958. If Congress appropriates funds for it, Sen. Warren Magnuson declared, there will be an airport program next year regardless of what the Administration wants. Lee assured Sen. Mike Monroney that if money were appropriated, he would be "willing to see that it was properly spent."

• **Lee agreed** that the federal program "in years when it has been of sufficient size, has done quite a bit to stimulate airport development." But when the size is reduced to the $14.3-million level of the current fiscal year, the administrator said, "there is serious question whether the program is a stimulant or a deterrent to airport construction, since the amounts for individual projects are so small as to accomplish little." There is some feeling in Congress and the Administration that if the program were completely called off, sponsors now waiting their turn for a federal grant would move forward with construction on their own.

• **Lee took no responsibility** for the original $30-million recommendation or the subsequent recommendation to eliminate it. He said he served only in "a staff capacity" in drawing up the $30-million program. Decision to eliminate it was "strictly an Administration decision" and he was not consulted on it, Lee said.

• **The CAA administrator endorsed** the Administration's decision to "take a breathing period" so the airport program could be reviewed and its future thoughtfully mapped. But he declined to commit himself on whether he thought it should be abolished. That is "an Administration policy matter," he said, involving relations between federal and state governments and federal policy on transportation aid.

"If the cities are going to have to build their own airports," Sen. Homer Capehart objected, "what control is the federal government going to have over

EDO TESTS DUAL HYDROSKI DEVELOPMENT

First photo of a Grumman JRF Goose modified by Edo Corp., College Point, N. Y., to test a dual hydroski configuration for Navy as part of a highspeed water-based jet aircraft program. This layout is similar to that fitted to the new Convair XF2Y-1 Sea Dart fighter. The airfoil profiles on the skis, mounted on shock absorbers below the hull, provide considerable hydrodynamic lift when running under water, boosting the airplane out of the water at comparatively low speeds and eliminating the planing run associated with conventional seaplanes. Extensive Edo and Navy tests have shown that hydroskis permit flying boat operations in much rougher water than the conventional flying boat hulls are capable of handling.

MiG Price Tag: $100,000 Delivered

Inflation apparently has hit the American market for Russian-built MiG-15 jet fighters. Gen. Mark Clark has offered $100,000 and political asylum to the first Communist pilot who delivers a MiG-15 intact to United Nations forces in Korea and $50,000 to any pilot who delivers one thereafter.

USAF planes are pushing the sales campaign by dropping leaflets with the offer over North Korea. Pentagon intelligence offices wryly recall an offer made three years ago to USAF in Europe by a Czech pilot to deliver a MiG-15 intact for $10,000 and the promise of personal political asylum.

The Czech was a former Luftwaffe fighter pilot who had flown German jets and was a civilian employe at a Russian base in East Germany where he regularly taxied MiG-15s from hangars to dispersal areas. A top USAF general in Europe summarily rejected the offer. That was in 1950 before the MiG-15 had appeared in Korean combat. Now the military is offering 10 times the Czech's price and three years later USAF does not have a flyable MiG-15.

the kind and type they build and how can there be a nationwide group of coordinated airports?"

• **Sen. Pat McCarran challenged** Lee's reasoning that a review of the program is justified because it originally was drawn in 1946 to accommodate an anticipated heavy volume of lightplane traffic that didn't materialize. McCarran said overwhelming emphasis has been on big airports. The $30 million proposed for fiscal 1954 earmarks $25.9 million for big airport grants, compared with $1.2 million for small fields. For the past five years, grant obligations for large airports total $157.1 million, compared with $12.9 million for small airports.

• **Sen. Capehart charged** the federal government with breaking its word to local governments in freezing projects and argued that the moral issue involved overshadowed the importance of cutting federal spending.

So far, $214 million of the $520 million authorized by Congress for federal airport aid has been appropriated. During the seven years the program has been in existence, appropriations have diminished. In fiscal 1947, the first year of the program, $45 million was appropriated. This was reduced over the years, reaching $18.7 million in fiscal 1952 and $14.3 million for current fiscal year. If the $306-million authorization is to be spent before the act expires in 1958, annual appropriations will have to average more than $60 million.

Report Air India Orders Comet 3s

Bombay—Air India International Ltd. reportedly has ordered two de Havilland Comet 3 jet transports for 1957 delivery.

The carrier's previous aircraft purchases have been from Lockheed. It is believed that the Comet deal does not affect Air India's current order for three Lockheed Super Constellations.

NATO Orders Five Jet Fighter Types

(McGraw-Hill World News)

Paris—Aircraft plants in Western Europe began tooling up last week for production of these jet fighters under North Atlantic Treaty Organization contracts totaling more than $550 million:

• **Hunters, Sea Hawks and Swifts** in Great Britain.

• **Mystere 2s** in France.

• **Hunters** in Belgium and The Netherlands.

• **F-86Ds** in Italy.

Assembly-line planning started almost immediately after the contracts were signed at a meeting of NATO ministers here, climaxing nearly a year of negotiations between the United States and member nations of the West Europe defense forces.

The coordinated European aircraft production program is expected to put 1,500 jet fighters into operation with western air forces by the end of 1956.

The U. S. is backing the program with $281 million in offshore procurement orders, and European governments are putting up almost an equal amount.

► **Ready to Roll**—Assembly lines in Great Britain are expected to get underway quickly. France is reported ready to roll, and production of the **Marcel** Dassault Mystere 2 already has started. Dassault will switch to the Mystere 4 as soon as a backlog of orders for the Mystere 2 has been filled.

Aircraft output in the three other nations—The Netherlands, Belgium and Italy—is expected to take longer. But NATO officials hope the three countries will show substantial progress by the end of this year.

The production breakdown:

• **Great Britain.** U. S. Air Force let contracts totaling $440 million for British production of the Hawker Hunter. U. S. Navy orders for the Hawker Sea Hawk amounted to $13 million. Britain ordered Vickers Supermarine Swifts under a $70-million contract.

• **France.** The U. S. placed $86 million in orders for the Mystere, and French government contracts for Mystere 2s totaled $91 million.

• **Netherlands and Belgium.** The U. S. let contracts totaling $18 million with The Netherlands and $24 million with Belgium for second-source production of the Hawker Hunter. Belgium will produce Rolls-Royce Avon engines—and Fokker will build fuselages in Holland. The Netherlands and Belgium together will spend $117 million for licensed production of the Hunter.

• **Italy.** United States is expected to award Fiat a $20-million contract for production of the North American F-86D. Details of this contract are not settled yet, but approval is expected soon. The Italian aircraft firm originally planned to produce British Gloster Javelins. But NATO switched to F-86Ds because the U. S. plane could be put into quantity production much faster. USAF figured it would take until the end of 1956 to set up production of the Javelin, a status that could be achieved a year earlier with the F-86D.

The Lion's Share

(McGraw-Hill World News)

London—The British aircraft industry will get $153 million from the U. S. and a healthy income in royalties from other North Atlantic Treaty Organization countries under offshore purchase contracts signed recently in Paris.

Biggest item is $140 million for 450 Hawker Hunter F-1 jet fighters, all of which will be delivered to U. S. control by June 1956. The U. S. Navy is spending $13 million in Britain for 100 Hawker Sea Hawks, scheduled for delivery within the next two years. The Royal Air Force already has ordered 500 Hunters.

The Netherlands and Belgium together will spend $117 million to produce some 200 Hunters themselves. Royalties will be paid by Fokkers in Holland to produce an estimated 100 Hunter airframes under a multi-million-dollar U. S. contract and by Fabrique-Nationale in Belgium for a similar number of Rolls-Royce RA 7 Avon jet engines (type tested to 9,500 lb. thrust with afterburner).

Tough Props

- **Shot-up Aeroprops bring pilots back in Korea.**
- **Steel-blade design gets credit for ruggedness.**

Aeroproducts-Allison Division, General Motors Corp., is gathering an impressive photo collection of badly shot-up propellers that brought their pilots back in Korea. The Aeroprop is standard equipment on the husky Douglas AD Skyraider attack-bombers, which have been carrying bomb loads to the Korean Red installations with regularity from U. S. Navy carriers.

The design of the Aeroprop blade, a steel forging with a central longitudinal rib capped by a sheet of steel brazed to the forging, gets credit for the strength which has made it possible for the shot-up blades to come back, still capable of performing their normal mission.

Here are three propeller case histories:

• Probably most spectacular demonstration by an Aeroprop on an AD was flown by Ensign Bill Doggett of Denton, Tex. He brought his Skyraider back more than 100 mi. to a UN landing strip in South Korea after a bombing mission in which his prop was hit by a 37-mm. anti-aircraft shell. The plane was punctured in 105 places. Accompanying photo (top) shows Doggett at right thrusting his hand through the hole in the Aeroprop to receive a congratulatory handshake from his skipper, Lt. Comdr. Harry McClaugherty, Attack Squadron 145, from the USS Kearsarge (CVA-33).

• Lt. Comdr. Lynn duTemple took a 37-mm. shell through his Aeroprop in his fourth bombing run on Hamhung railroad bridge. He didn't discover it, Navy reports say, until he had landed back on the USS Princeton. Photo (center left) shows duTemple with the pierced blade.

• Lt. (jg) Robert Notz's Skyraider had an 18-in. long section shot out of its Aeroprop by a flak hit in a low-level attack over Wonson, Korea. The hit sliced into the trailing edge, carved deep into the center rib section.

The Aeroprop also is used on the Grumman F8F Bearcat, built for the Navy and now being used in the fighting in Indo-China for close air support operations.

Aeroprop's dual counter-rotating propellers now in production will be used in the Douglas A2D, advanced version of the Skyraider, and on the North American XA2J. Neither of the latter planes is in production.

THEY GOT HOME

Graphic examples of battle-scarred Aeroproducts propellers that held together and enabled their pilots to make it back home are shown in the photos above; the cutaway at right gives inside details of these propellers.

Top photo shows Douglas Skyraider propeller punctured by 37-mm. cannon shell that left a hole large enough to put a man's arm through.

At left center is another prop pierced by a 37-mm. shell, while next to it is a prop that had 18 in. of its trailing edge sheared off.

Hollow-blade construction of a typical Aeroproducts propeller is bared at right. Note the longitudinal strengthening rib.

The Douglas AD Skyraider series is fitted with four-blade steel propellers of approximately 13 ft. 6 in. diameter.

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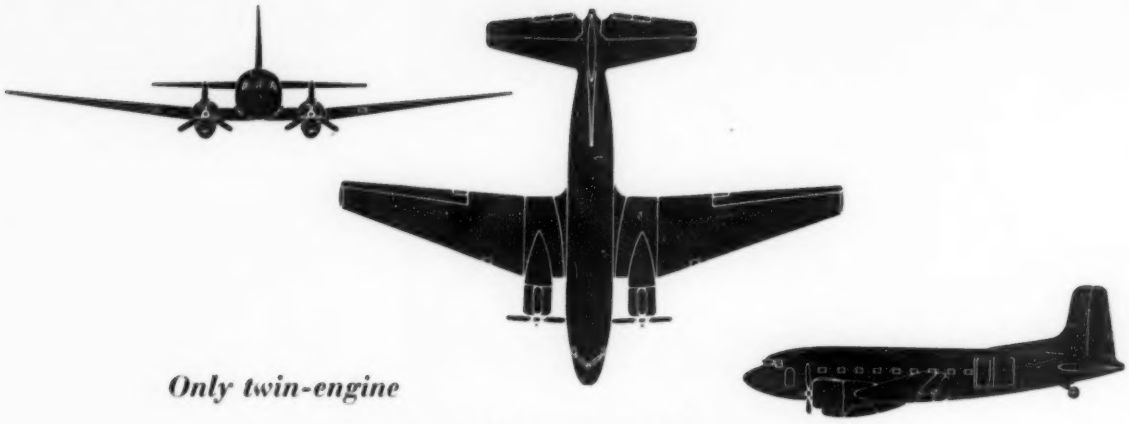

Only twin-engine

transport that makes regular flights

to Hawaii, the Navy's

Douglas R4D-8

Unique among twin-engine aircraft is the Navy's Douglas R4D-8. On orders, this transport can take off at San Francisco and safely wing its way across 2,562 miles of open Pacific to Hawaii.

Born of the Douglas DC-3, world's best known airplane, R4D-8 is longer, more powerful and flies on new swept wings. It carries 2,800 more pounds of payload 45 m.p.h. faster than its famous parent. Ceiling and range are greater. Passenger and freight loading are easier, quicker. And along with its improved performance, the Douglas R4D-8 still combines DC-3 reliability with twin-engine economy.

Development of the R4D-8 is another example of Douglas leadership in aviation. Planes that can be produced in quantity to fly *faster and farther with a bigger payload* are a basic Douglas rule.

Enlist to fly with the U.S. Navy

Depend on *DOUGLAS* **First in Aviation**

Foreign Aircraft Gasoline Needs (Excluding Iron Curtain countries)

(In thousands of barrels)

	1952	1953	1954	1955	1956	1957	1962
Western Hemisphere..	8,207	9,100	9,760	10,400	11,000	11,550	14,000
Europe	10,195	11,300	11,730	12,000	11,900	11,800	10,000
Balance Eastern Hemisphere	9,231	9,530	9,900	10,450	10,680	10,960	11,405
Total Eastern Hemisphere	19,426	20,830	21,630	22,450	22,580	22,760	21,405
Total foreign.....	27,633	29,930	31,390	32,850	33,580	34,310	35,405

Avgas Demand Exceeds Supply

More aviation gasoline production facilities are needed in the Eastern Hemisphere this side of the Iron Curtain to supplement present plants, which cannot maintain increasing demands abroad, Deputy Petroleum Administrator J. Ed Warren reports.

Petroleum refining facilities have expanded throughout the Eastern Hemisphere, Warren says, but construction of plants for production of aviation gasoline have lagged far behind.

Petroleum Administration for Defense officials in Washington believe the demand for aviation gasoline will continue to increase abroad at least for another five years. Then it is expected to level off for the next decade as the turn is made from piston-powered aircraft to jets.

► **Western Demands**—In the Western Hemisphere outside the U. S., PAD officials expect the turn to jets to be slower, so that aviation gasoline demands will continue to rise throughout the next ten years.

This year, European daily consumption of aviation gasoline alone is estimated at 31,000 barrels. By 1955, it will be 32,900 barrels per day, 32,300 barrels in 1957 and about 27,400 barrels in 1962, experts report. Consumption in the Western Hemisphere, outside the U. S., should be 25,000 barrels a day this year, officials say, 28,500 barrels in 1955, 31,600 barrels in 1957 and 38,400 barrels in 1962.

► **Exports**—Production of aviation gasoline outside the U. S. as of Jan. 1 amounted to only a little more than 38,000 barrels a day. Foreign requirements for 1953 average about 82,000 barrels a day. The deficit will be made up through exports from this country.

Caribbean countries, Mexico and Canada are producing nearly 32,000 barrels a day, while 4,300 barrels are produced daily in the Far East. The United Kingdom manufactures roughly 2,300 barrels a day at the present time.

PAD reports that no new facilities are known to be planned for production of aviation gasoline despite the prospect of an increasing demand in Europe and the Eastern Hemisphere at least for the next few years.

NEW CESSNA 180 APPROVED FOR FLOATS

Cessna Aircraft Co.'s new four-place 180 pictured fitted with Edo 2425 twin float. Even with this added weight and drag the 180 cruises at more than 135 mph. and has 940-fpm. rate of climb fully loaded. Service ceiling of the seaplane is 16,500 ft. The floats are fitted with twin water rudders to enhance surface maneuverability.

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RELIABLE

MINIATURE

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ALUMINUM

Pennsalt AE-16

non-sludging • non-scaling • long-lived • time-saving • money-saving

Good news for fabricators! With Pennsalt's great new etchant—AE-16—you can give aluminum a beautiful satin finish *without* experiencing the usual headaches of sludge and scale—and at considerable lower cost than with *any* equivalent product!

Here's a case in point: A leading aluminum fabricator ran a side-by-side production test with AE-16 and an old-style etchant. After *nine weeks*, the original tankful of AE-16 had formed no sludge, was still performing satisfactorily! The old-style etchant had to be dumped and recharged twice in the same period.

Of course, AE-16's non-scaling characteristic means reduced tank maintenance costs, also. The AE-16 tank was cleaned by merely flushing it down with a hose—no chipping, no shoveling of rock-like scale.

AE-16 is a *quality* etchant In from one-half to ten minutes at normal tank temperatures, it produces a smooth, even, satin surface that easily conceals die marks and surface flaws. Few additions are required to keep up its working strength, and you'll find Pennsalt's method for determining the concentration exceptionally easy to follow.

All this means less down time, trouble-free operation, lower maintenance costs, increased production. Yet, even with its many advantages, *AE-16 actually costs less* than any comparable product on the market!

AE-16 is part of a complete aluminum preparation "package" Pennsalt now offers to fabricators. To help you use these excellent materials with maximum efficiency, Pennsalt also offers a Metal Processing Service, staffed by specialists in this field.

Further information—on AE-16 or on any of the other products in the Pennsalt "package"—is yours for the writing. Address: Metal Processing Service, Pennsylvania Salt Manufacturing Company, *East:* 289 Widener Building, Philadelphia 7, Pa. *West:* 2168 Shattuck Ave., Berkeley 4, Calif.

The Pennsalt Aluminum "Package"

Pennsalt Cleaner A-27: A new all-purpose non-etching cleaner that thoroughly removes all tough soils, including red and black marking inks. Rinses quickly and completely, even when allowed to dry on the work. Will not streak or stain.

Pennsalt Aldox*: A new powdered, acid-type desmutter and deoxidizer. Replaces nitric acid, does away with carboys and fumes.

Pennsalt Cleaner #85: An alkaline cleaner and deoxidizing agent recommended when aluminum is coated with a heavy layer of oil.

Pennsalt Cleaner MC-1*: An unusually economical general-purpose deoxidizing-type cleaner.

Pennsalt Cleaner EC-51*: A non-staining, organic-type emulsion cleaner.

Pennsalt Cleaner EC-54*: An emulsion cleaner which will not boil off, evaporate, or flash at use temperatures.

*Trade Name of PSM Co.

Pennsalt Chemicals

CAA Lists Renewed Airport Aid Projects

Civil Aeronautics Administration is going ahead with 63 federal airport aid projects that were approved under the fiscal 1953 program at a cost of $5.5 million.

Funds for the program were approved by the 82nd Congress, but they were frozen early in February by the Bureau of the Budget.

Projects earmarked for $100,000 or more:

- **Albany, N. Y.,** $100,000 for installation of new taxiway lights and elevated lights on the NW/SE runway, resurfacing of certain taxiways and rehabilitation of drainage facilities.
- **Boston, Mass.,** $250,000 for construction of a control tower with space for the Boston Air Route Traffic Control Center and the CAA communications station.
- **Buffalo, N. Y.,** $150,000 for construction of a bypass taxiway auto parking area and roadway; reconstruction of aircraft parking area; installation of controllable wind tee, taxiway and apron lighting and standby power source; terminal area fencing and related utilities.
- **Cleveland, Ohio,** $325,000 for construction of the main unit of the terminal building.
- **Columbus, Ohio,** $176,000 for construction of the control tower as a first stage of the construction of the terminal building, entrance road, auto parking area and miscellaneous landing aids.
- **Juneau, Alaska,** $225,000 for first-stage construction of a 1,500-ft. extension of the existing airport, access road, seaplane facility, mooring and pull-out facility.
- **Long Beach, Calif.,** $192,197 to acquire land and easements for approach protection to instrument runway, remodel control tower and construct fire station.
- **Newark, N. J.,** $200,000 to construct storm sewer drainage system.
- **New York, N. Y.,** $100,000 to construct apron, taxiway, access road and parking area.
- **Pittsburgh, Pa.,** $200,000 to rehabilitate runways and construct new control tower.
- **Portland, Ore.,** $207,925 to acquire land for airport expansion.
- **Corpus Christi, Tex.,** (Cliff Maus) $200,000 to acquire land and easements, construct terminal building and control tower, and install high-intensity lights on instrument runway.
- **Miami, Fla.,** (International) $31,239 to extend water main and complete sewage treatment system, increasing project authorization to $192,664.
- **Memphis** Tenn., $120,000 to strengthen runways and taxiways.
- **Philadelphia, Pa.,** (International) $200,000 to pave in front of new terminal building.
- **Salt Lake City** (Municipal No. 1) $348,713 to acquire land, pave and mark new instrument runway with connecting taxiways, install high-intensity runway lights and install taxiway lights.
- **Milwaukee, Wisc.,** $210,000 to construct second stage of terminal building.
- **Peoria, Ill.,** $145,000 to construct taxiway from terminal area to south end of N/S runway and to connect north end of N/S runway with NE end of NE/SW runway.

Four Airlines Raise Executives' Salaries

Top executives of four airlines received annual increases ranging from $500 to $5,522 last year, according to salary, compensation and stock holding reports to the Civil Aeronautics Board.

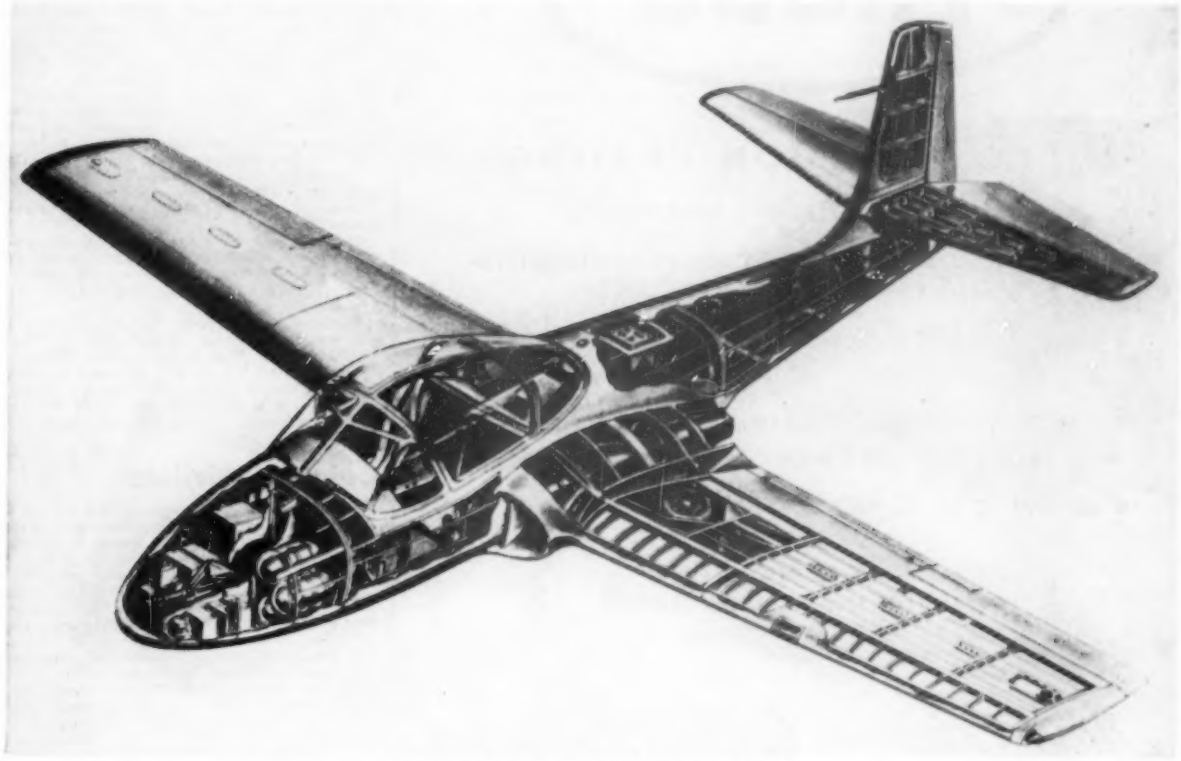
Delta Air Lines president C. E. Woolman climbed from a salary in 1951 of $30,000 to $35,522 in 1952, highest increase listed in reports by DAL, Continental Air Lines, Colonial Airlines and Hawaiian Airlines.

The reports, with comparable 1951 figures shown in parentheses:

Delta Air Lines

Woolman, president and general manager, $35,522 ($30,000), owns 32,457 shares; Charles H. Dolson, vice president-operations, $23,094 ($20,000), owns 1,300 shares; Laigh C. Parker, vice president-traffic, $23,660 ($21,000), owns 1,500 shares; Todd G. Cole, comptroller-assistant secretary, $12,708, owns 120 shares; Travis Oliver, treasurer, $1,200, owns 1,895 shares; C. H. McHenry, secretary, $1,200, owns 1,500 shares; Catherine Fitzgerald, assistant treasurer, $6,672 ($4,800), owns 3,300 shares.

Directors: Woolman, Parker, Oliver and McHenry—shown above; others: D. Y. Smith, fees $80, owns 1,230 (1,050) shares;



INSIDE DETAILS OF CESSNA 318

Large cutaway drawing of new Cessna 318 twin-jet light trainer, which won a USAF design competition, shows details of craft's structure and placement of equipment. The two occupants sit side-by-side. Note how the port Turbomeca-designed Marbore turbojet engine is faired in the wing root. These engines are to be built in the U. S. by Continental Motors Corp. The 318 design was chosen over 14 other entries submitted by other companies. Spanning 33 ft. and 27 ft. 1 in. long, the plane has a design gross weight of approximately 5,600 lb. Top speed will be approximately 400 mph.

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Richard W. Freeman, $80, owns 6,000 (7,000) shares; Edward H. Gerry, $80, 1,100 (1,400) shares; Winship Nunnally, $100, owns 10,000 shares; R. J. Reynolds, owns 90,900 (113,900) shares; R. W. Courts, $80, owns 2,461 (50) shares.

Persons and organizations other than company officials receiving more than $10,000 in the year: Pogue & Neal, Washington, $50,331 ($21,088), legal; Alston, Foster, Sibley & Miller, Atlanta, $15,985, legal; Arthur Anderson & Co., Atlanta, $10,642, auditing, tax, and special services; Courts & Co., Atlanta, $14,265, financial research and counsel.

Persons holding 5% or more of total outstanding Delta stock: R. J. Reynolds, 90,900 (113,900), shares, 15% (23%); Woolman, 32,457 shares, 5% (6%).

Continental Air Lines

Robert F. Six, president, $34,833 ($33,000), owns 1,000 shares common; C. C. West, Jr., vice president, $18,419 ($17,375), owns 440 shares; O. R. Haueter, vice president-operations, $18,875 ($17,375), owns 763 shares; Joseph A. Uhl, vice president and treasurer, $15,917, owns 1,317 shares; L. H. Dennis, vice president-flight service, $7,950 ($7,083); Stanley O. Halberg, vice president-traffic and sales, $8,325 ($7,438), owns 200 shares; Harry C. Short, vice president-engineering and maintenance, $12,500 ($7,813); S. B. Redmond, secretary, $7,521, owns 175 shares; George J. M. Kelly, assistant secretary, $3,708, owns 355 shares.

Directors: Louis H. Mueller, chairman of the board, owns 22,450 shares; Lawrence C. Ames, fees $600 ($500), owns 11,700 shares; Shedlon G. Cooper, $700 ($900), owns 4,050 (1,600) shares; F. L. Ehrman, $100, has 2,000 shares beneficially; Marco F. Hellman, $400 ($900), owns 3,250 (5,000) shares; Josiah G. Holland, $500 ($100), owns 3,100 (2,300) shares; Frank H. Ricketson, Jr., $300 ($100), owns 4,800 (4,300) shares; Thomas Roberts, $200, owns 62,050 shares.

Persons and organizations other than company officials receiving more than $10,000 in the year: C. Edward Leasure, Washington, $13,500 ($21,000), legal services; Holland & Hart, Denver, $12,000 ($13,000), legal services; Harold Judson, Los Angeles, $51,600, commission on sale of aircraft; Cooper, White & Cooper, San Francisco, $18,500, legal services; Coverdale & Colpitts, New York, $14,850, business consulting.

Persons holding more than 5% of outstanding stock Dec. 31, 1952: estate of William H. Erhart, 62,050 shares (same), 16% (20%); Louis H. Mueller, 22,450 (same), 6% (7%).

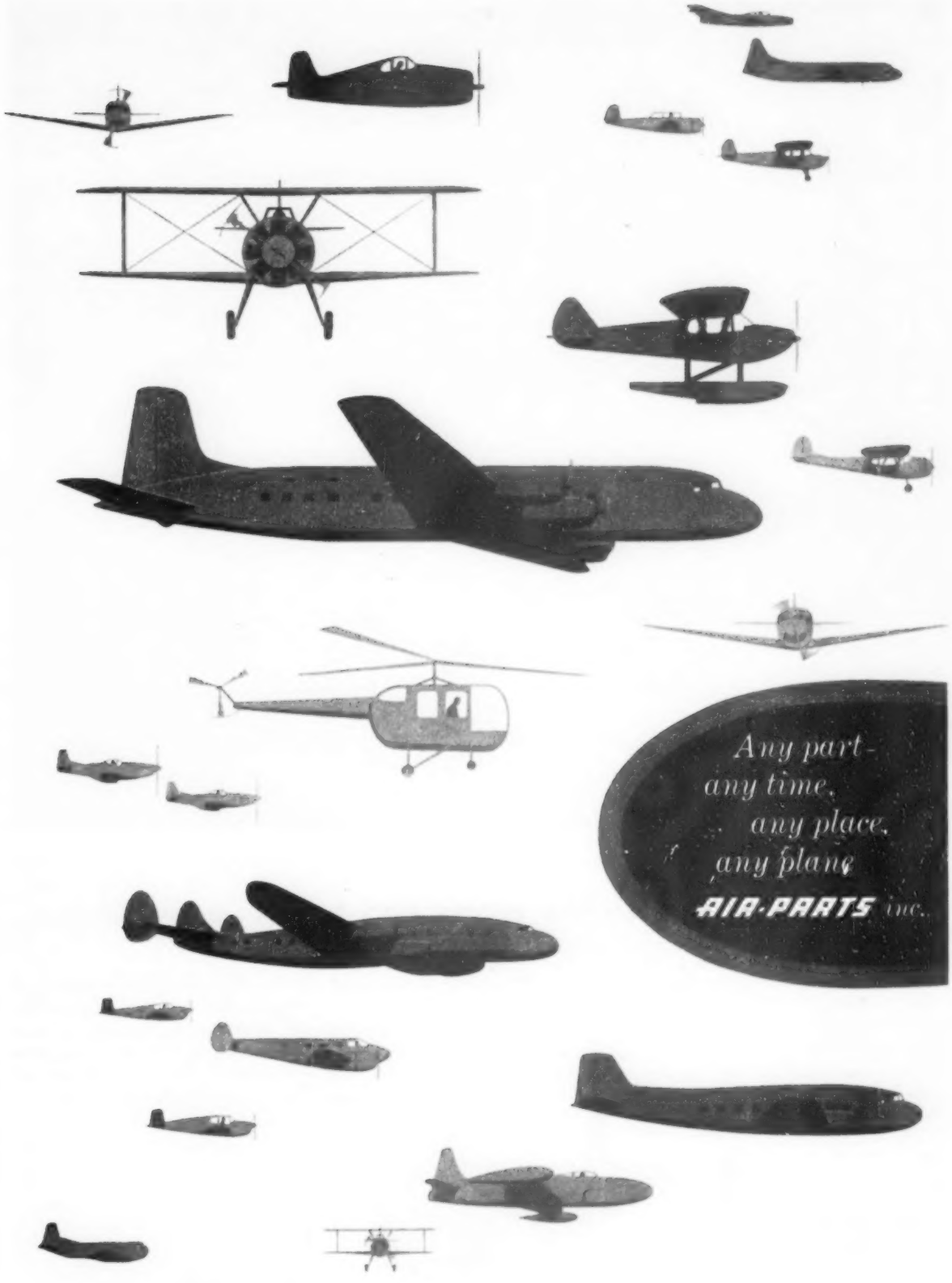
Options outstanding to buy common stock at $6.75 per share are held by: Six, 10,000 shares; West, 3,000 shares; Haueter, 3,000 shares; Uhl, 2,500 shares; Dennis, 1,500 shares; Halberg, 1,500 shares; Short, 1,500 shares; and Redmond, 1,500 shares. (Previous options at $8.41⅔ per share expired Jan. 28, 1953.)

Colonial Airlines

Branch T. Dykes, president and director, $22,800 ($16,000 as vice president 1951), owns 500 shares common; Alfons B. Landa, former president and director, $1,500 ($6,533); Thomas J. Dunnion, chief accounting officer, $15,000 (same), owns 200 shares; Robert H. Herrnstein, vice president-accounting, treasury and sales, $12,800 ($7,604), owns 50 shares; James F. Gormley, treasurer, $10,923 ($12,500); Thomas A. Campo, assistant treasurer, $6,370; Norman D. MacDonald, former treasurer, $7,258 ($5,872); L. Orville Cameron, vice president-secretary, $13,950 ($7,583), owns 300 shares; Donald A. Duff, (deceased) vice president and general manager, $5,712.

Other directors: Edmond M. Hanrahan, chairman of the board, fees $900, owns 100 shares; John J. Murphy, former chairman, salary $10,000 ($3,500) and $5,000 ($150) indirect compensation; A. Charles Schwartz, fees $1,100, owns 100 shares (none); Joseph V. Shields, $1,000 ($400), (owned 20,000 shares); Francis Hartley, Jr., $600 ($250), owns 3,704 shares (none).

Persons and organizations other than



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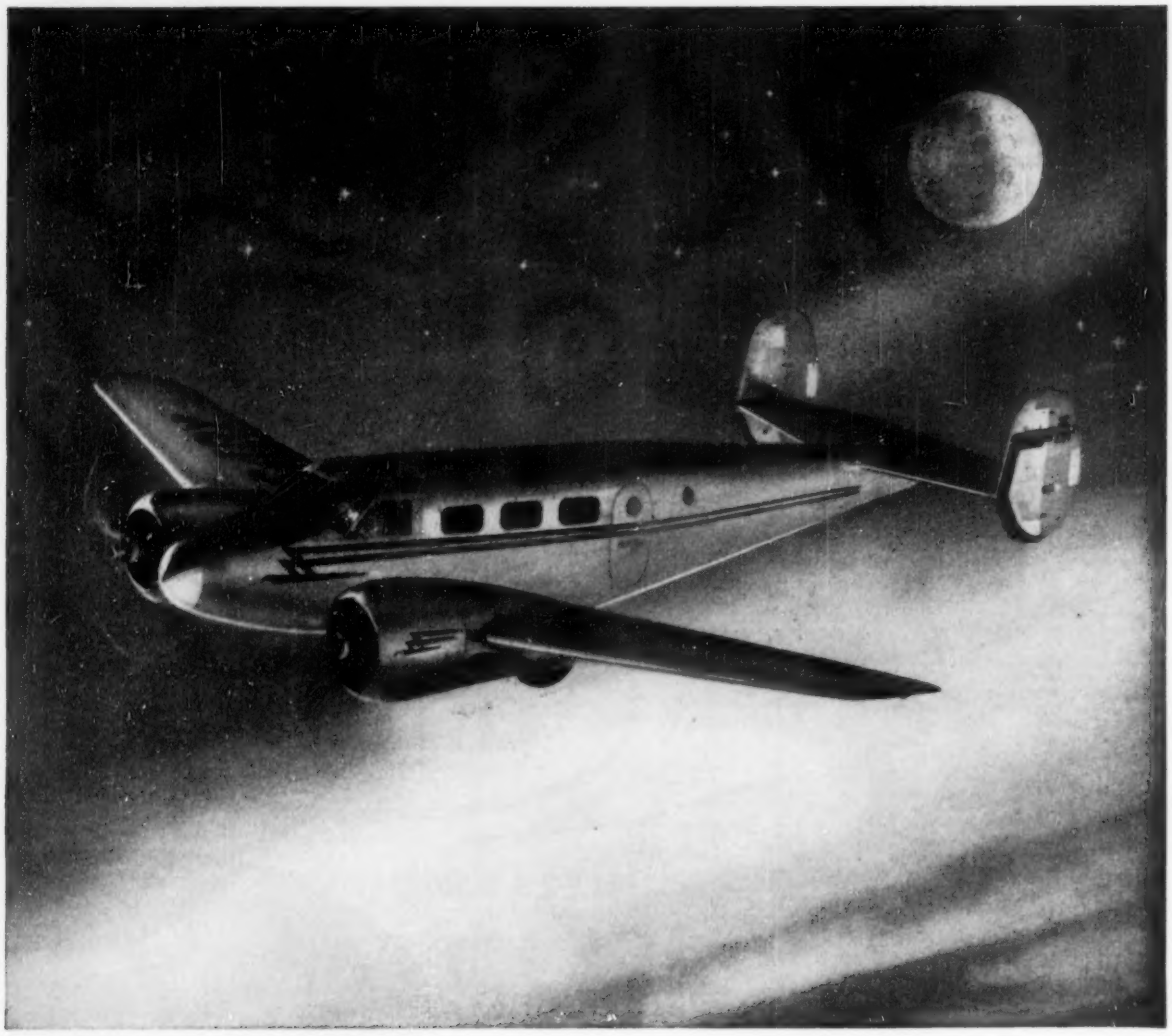

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Royal Canadian Air Force Expeditor. Beech "Twins" will serve for pilot and navigation training, and communications work.

Beechcraft

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company officials receiving more than $10,000 in the year: Davies, Richberg, Tydings, Beebe & Landa, Washington, $11,250 ($27,000), legal fees, general and route development, Jan. 1-May 13, 1952; Sullivan, Donovan, Heenehan & Hanrahan, New York, $11,250, legal fees, general and route development, May 13-Dec. 31, 1952; Sullivan and Cromwell, New York, $23,650 ($12,750), legal fees; A. Young & Co., $7,000, legal fees, and $8,500, auditing.

Only organization owning 5% or more of total outstanding stock at Dec. 31, 1952, is McKenna & Co., 26,200 shares.

Options to buy common stock at $12.25 a share are held by Dunnion, 5,000 shares, and Sigmund M. Janas, Sr., 80,000 shares—on which Colonial reports: "said option being regarded by Colonial as void and being now the subject of a suit for cancellation in the federal court in the state of New York."

Hawaiian Airlines

S. C. Kennedy, president and director, salary $28,700 ($28,250), fees $260, owns 22,792 (20,346) shares common stock; Ford Studebaker, vice president, $16,200 ($15,750), owns 1,600 shares; David Watson, vice president-treasurer, $13,700 ($13,250) and $20, owns 1,650 shares; John Pugh, secretary, $10,080 ($9,320) and $20, owns 500 shares; Brian Cooke, assistant treasurer, $8,820 ($8,241), owns 300 shares.

Other directors: M. B. Carson, $220, owns 7,500 shares; James Greenwell, $220, owns 550 shares; Thomas Guard, $240; Dudley C. Lewis, $260, owns 100 shares; P. K. McLean, $340 ($120), owns 200 shares; J. E. Russell, $220 ($180); W. C. Tsukiyama, $220, owns 50 shares; George Vicars, $280 ($220), owns 800 (550) shares; H. V. Von Holt, $160, owns 500 shares; R. Von Tempsky, $200 ($250), owns 1,157 (50) shares; H. W. H. White, $240 ($180); G. P. Wilcox, $100, owns 4,155 shares; Robert T. Williams, $80 ($140), owns 50 shares; George S. Wong, $160 ($240), owns 1,000 (645) shares.

Only person reported holding 5% or more of total outstanding stock Dec. 31, 1952, is Stanley C. Kennedy, 22,792 (20,346) shares, or 6½%. (Previous year, Inter-island Steam Navigation Co. owned 30,009 or 6%).

Lockheed, Bellanca Report Top Salaries

Robert E. Gross, president and board chairman of Lockheed Aircraft Corp., received total salary of $119,175.24 during 1952, the airframe manufacturer reported last week to the Securities & Exchange Commission in Washington, D. C.

Of the $708,213.48 received by all officers and directors during the year, the corporation paid Courtlandt S. Gross, executive vice president, $89,624.92; C. A. Barker, Jr., vice president and treasurer, $84,300.24; J. V. Carmichael, vice president, $42,584.64; Cyril Chappellet, administrative vice president, $65,325.32; Hall L. Hibbard, vice president, $64,800.32; and Carl B. Squier, vice president of sales, $56,700.28.

Bellanca Aircraft Corp. of New Castle, Del., reported it paid all officers and directors $44,808.78 during 1952, an increase of $4,188.99 over salaries paid during 1951. No officer of the airplane manufacturer received as much as $25,000.

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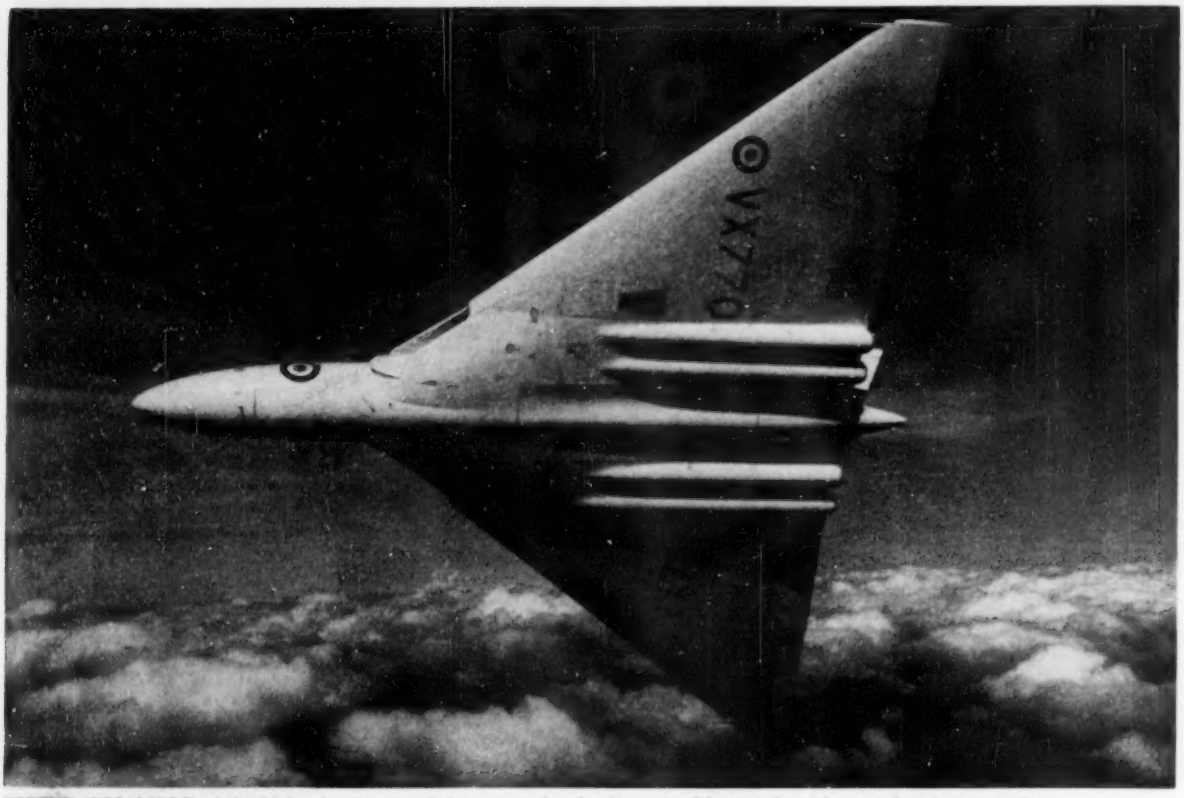


TIPPED TRIANGLE of the Vulcan's wing reveals important details of structural layout, shows layout of surface controls.

Avro Vulcan: Evolution of a Delta Bomber

- **Analysis of Great Britain's super-priority, four-jet triangle-wing plane shows why it is what it is.**
- **Speedy, high-flying, far-ranging 698 reaps benefits of design of its forerunners, the 707 series.**

By David A. Anderton

The sleek white Avro Vulcan, four-jet delta-wing bomber, is the pride of the Hawker Siddeley Group and the boast of British aeronautical circles.

Now in super-priority production for the Royal Air Force, the Vulcan has been widely touted as the world's best bomber, carrying highest loads faster, further and at higher altitudes. It has also been credited with giving Britain the lead in delta-wing planes.

▶ **Right or Wrong?**—These statements aren't exactly wrong, but they aren't exactly right, either. The novelty of the design, its impressive and dramatic performance at Farnborough last fall and the accolade of "super-priority" have contributed to a build-up of the airplane unequaled within recent memory for any other type except the Convair B-36.

But: Only one Vulcan is flying now, and nearly every other British military type and three civil transports enjoy the super-priority rating and the current belief is that only about two dozen Vulcans are going to be built anyway.

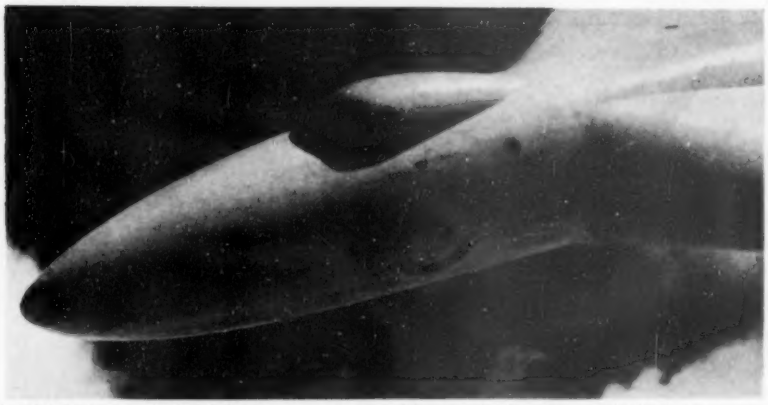
Further, the plane is not yet a bomber (neither is the B-36, if you define a bomber as an offensive weapon in use), and other British firms have claimed the "higher, faster, farther" labels for their own.

As for the British lead in deltas, there could be considerable argument from the many U. S. proponents of the design, with Convair—who did it first—heading the list.

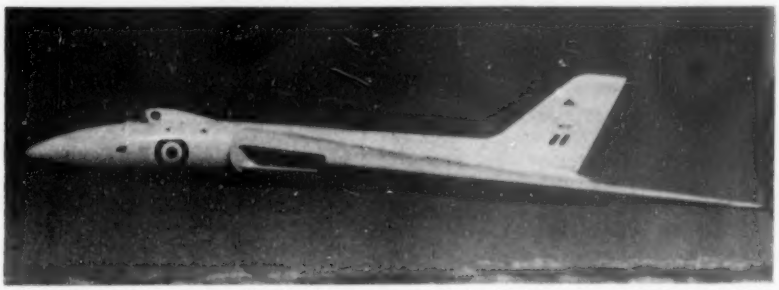
But there is no denying that the Vulcan is an impressive approach to a tough design requirement. It stands as a tribute to the objective engineering and management teams that saw the delta as their answer and had the courage to push it through from drawing boards to flight tests.

▶ **The Vulcan**—When Avro's big white delta made its first flight over the heads of an awed crowd at Farnborough last September, only a couple of hours flying time had been run up on the plane. Yet Avro—and the Vulcan's pilot, Roland Falk—had complete confidence in the behavior of the plane.

This was only the first indication that there was a tremendous amount of research and development behind the Vulcan. Viewing it, observers immediately saw the purpose of the little 707 series of flight-test deltas, and recognized the value of the air time logged in the Avro Ashton high-altitude research craft.



COCKPIT CLOSEUP indicates use of ejectable capsule in place of individual ejection seats. Note boundary-layer separator and inboard wing configuration.



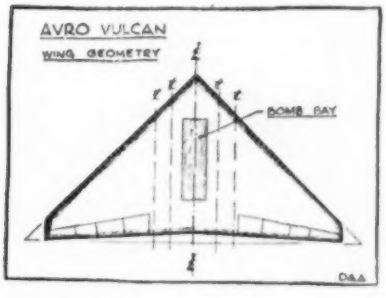
IN PROFILE, the curious "broken" appearance of the Vulcan comes from the fairings under the turbojets and the straight lower line of the delta wing.

In spite of its 100-ft. wingspan, the Vulcan is deceptively small in appearance. Its agility and speed, added to the low altitude at which Falk made the bulk of his flight demonstration, furthered that impression.

Most of the detailed information on the Vulcan is still on the secret list. But it has been reported that the plane grosses over 100,000 lb. and that production versions will have Bristol Olympus turbojets replacing the Rolls-Royce Avons of the experimental job.

► **Interpretation**—Beyond that data, it is necessary to go to the many photographs of the Vulcan for more of its characteristics.

The wing geometry of the Vulcan is based on approximately 45-deg. sweep angle of the leading edge. The trailing edge is not straight from tip to tip, but breaks forward at the airplane center line. The wingtips do not come to a point following the triangular layout, but are chopped off parallel to the airplane centerline a few feet in from the tip.



Two paired control surfaces extend along the wing trailing edge from just outboard of the four engines to the tip. Inboard pair are elevators, and the outboard pair are ailerons.

Each control surface is divided in half along its chord; in spite of this obvious division, no picture shows either section of a single surface working independently of the other. Leading edge of these surfaces is at about the 80% chord line on the inboard end, and at about 60% chord at the outboard.

If 100 ft. is reasonably accurate for the wing span, then the aileron span is 17 ft., and the elevator span is 19 ft. If 100 ft. is not correct, then those figures can be thought of as percentages of span.

Thrust line of the inboard engine pair is 7 ft. from the airplane centerline; the outboard pair is 12 ft. from the centerline. This checks approximately with photos of the Vulcan taken from astern.

On the same basis as the above estimates, the bomb bay is about 25 ft. long, and about 7 ft. wide. Landing gear tread is about 31 ft. The fuselage diameter scales to be about 9 ft.

► **Other Features**—Paired airbrakes are mounted above and below the Vulcan wing over the engine bays. These resemble a plate held flat against the wind

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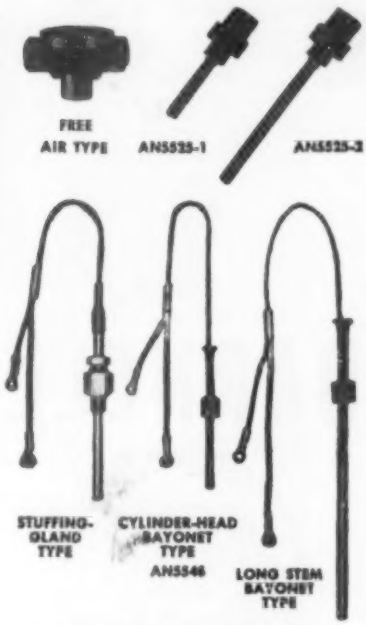

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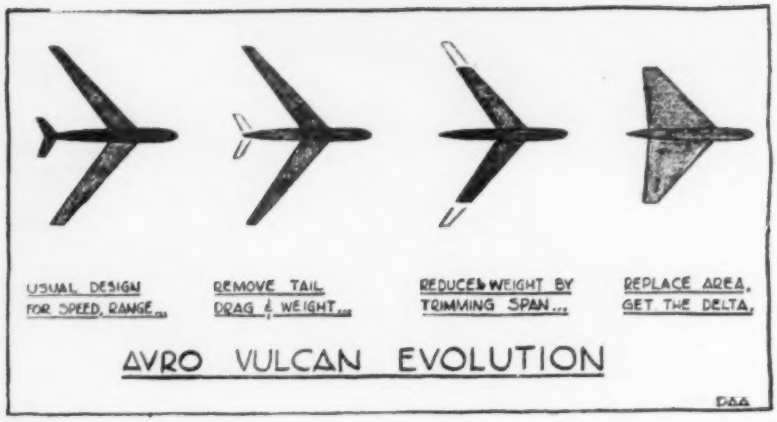
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by a pair of posts, and must produce a considerable amount of drag for their size.

Wing inlets to the four buried turbojets are in the form of a straight slot with a separator a couple of feet inside the lips. A boundary-layer separator is mounted between the inboard end of the intake and the fuselage.

One interesting detail of the Vulcan is the huge number of supplementary air inlets. There are 13 on the underside of the wings along, and there is a tiny one far forward on the port side of the dorsal fin.

The cockpit arrangement warrants close attention. Its side is marked with the usual triangle signifying an ejection seat, but there doesn't seem to be any jettisonable portion of the hood. There is a line of demarcation—visible in the cockpit closeup—which is about one foot away from the intersection of cockpit and fuselage lines. That clue, plus the similarity of the nose cockpit sections on the Vickers Valiant and the Avro Vulcan, hint of the use of a standardized jettisonable capsule for escape, rather than individual seats.

► **Structural Considerations**—One of the big advantages of the delta layout from the British point of view is that a large aircraft can be built with small-aircraft techniques and machinery. For the under-machined British aircraft industry, this is good.

Again resorting to the photographs, it is possible to get some valuable clues to the kind of structures which lie under the white skin of the Vulcan.

The wing section from centerline to just outboard of the engines is built around members which run parallel to the centerline. This is the structural heart of the big delta. Outboard of this section, is apparently a multi-celled structure, with its leading-edge spar at about the 15% chord mark. The trailing-edge spar varies in location from about 70% inboard to only about 15% at the tip (see sketch at right).

Spanwise stiffeners run roughly parallel to the leading-edge spar; thus, access doors are either trapezoids or parallelograms.

The fuselage is circular in cross-section, and probably conventional in structural makeup. The vertical tail also appears to offer nothing radical in construction ideas.

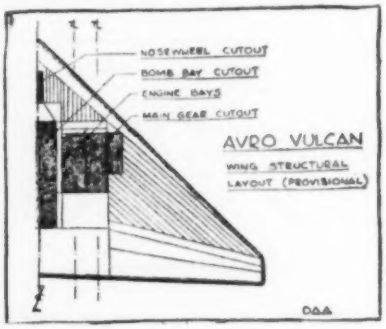
► **Genesis**—The design pros and cons of the delta wing layout have been presented before, in considerable detail (AVIATION WEEK Sept. 17, 1951, p. 20).

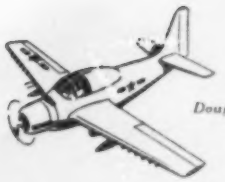
But the thinking that led to the evolution of the Vulcan as the best answer to the RAF requirement has only recently been told.

In response to the bomber requirement, a group of six in Avro's Projects Department began the design merry-go-round. They finally seized the brass ring in the fall of 1952 when the RAF placed the production order.

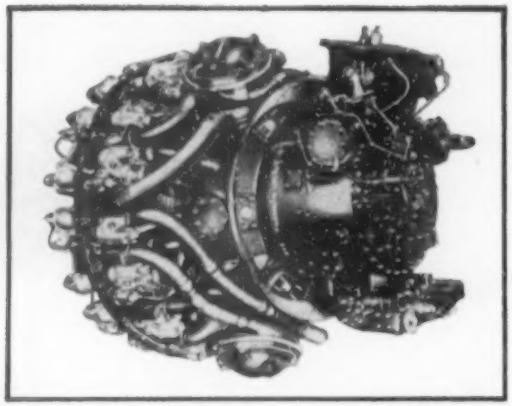
Under the leadership of Stuart Davies, chief designer of Avro, the team studied a variety of configurations. "It was obvious from the start," says Davies, "that no conventional aircraft, as we then knew them, would do the job the Air Staff were asking for. . . . The first idea we produced was an aircraft three times as big as the machine the Air Staff wanted—and we could still not see how we could get the performance they required."

"The next stage in our thinking turned against the Air Staff's requirements. Are they ridiculous? Have they made a mistake to ask for all these qualities in one aircraft? . . . Then we started to think again and studied projects





Douglas "Skyraider"



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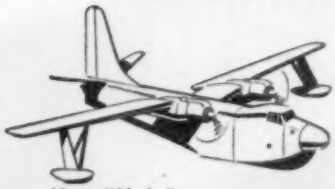
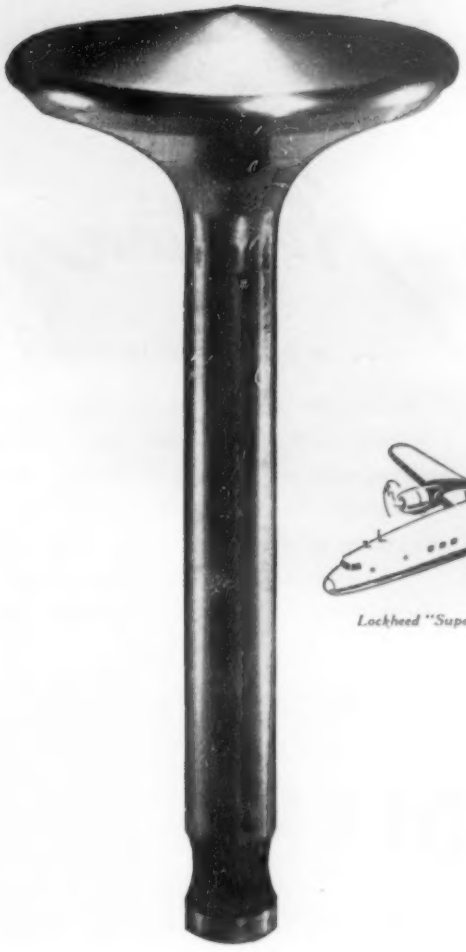


Martin "Marlin"



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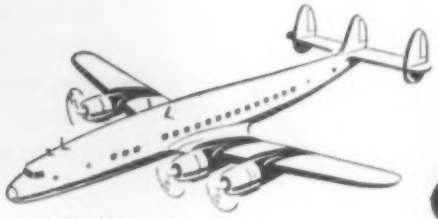

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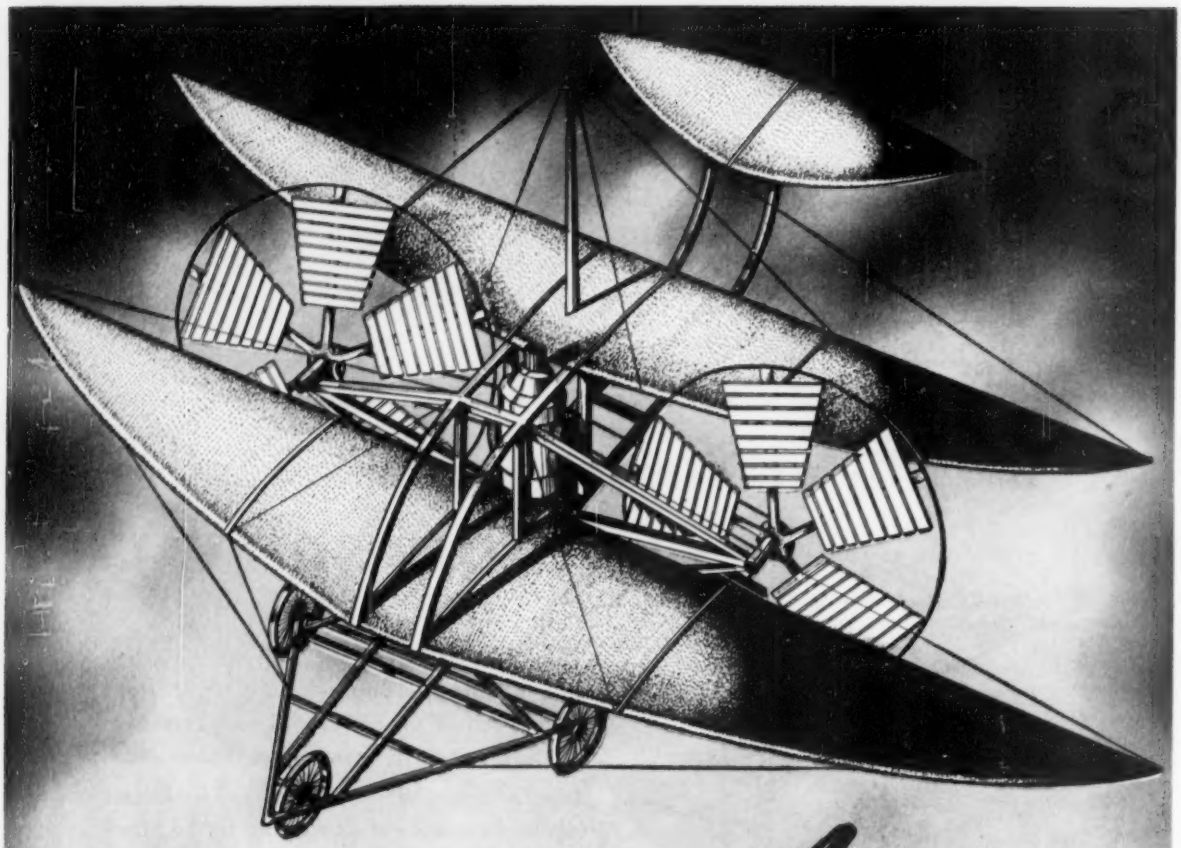

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embodying thin sweptback wings and low wing loading in various configurations."

▶ **Further Work**—But the high speed required for the bomber meant that a sweptback wing layout would weigh more than Davies felt could be afforded; this would have reduced the payload, and so the concept was ruled out. They thought of eliminating the tail and using the wingtips of the swept wing for control. By getting rid of the tail, its weight and drag were saved; but the structural penalty of the swept wing was still too severe.

So the design team considered other layouts for about a month, using as data some designs for the Brabazon 3, a civil jet transport which never materialized, and German tunnel tests on sweepback. The team whittled away at the weight of the swept wing by systematic design studies. They reduced the span, compensating for that effect on sweep, thickness and wing area.

Davies states: ". . . We reduced the weight by reducing the span, and, as this reduced the area, which we didn't want to do, we put the area back by filling in the space between the sweptback wing and the fuselage. The result of all this logical thinking was the delta."

▶ **Backing**—At this stage, Avro management took the plunge and backed the proposal for a triangular craft to the Air Ministry. Through 1947 the design team worked on the official specification of the Type 698, and by fall of that year the Air Staff and Ministry of Supply had the facts and figures of the new design.

By the end of 1947, the word was handed down to go ahead and build a prototype. "It was a bold decision," says Davies, "and I believe the Air Staff at that time showed foresight in demanding the high performance in their requirements; and courage in placing the order when no previous delta-wing aircraft had flown."

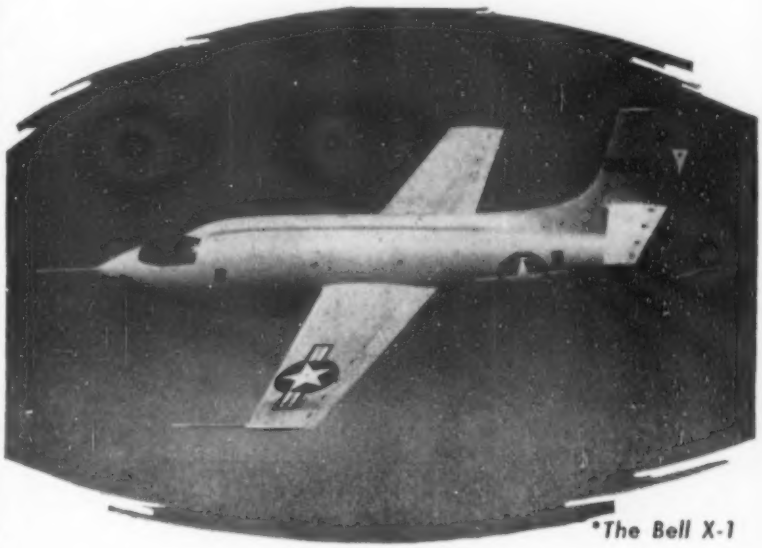
Because of the lack of information on the flying characteristics of such radically different planes, Avro proposed to the Ministry of Supply that some small test research planes be built. They were given the go-ahead and began design of the 707 series in 1947.

By September 1949 the first of these, the Avro 707, was in the air for the start of a short life. It crashed soon after, and pilot and plane were lost.

The second plane, the 707B (AVIATION WEEK Oct. 9, 1950, p.20), flew in time for the 1950 Farnborough display, and the third 707, the A, flew for the 1951 show. Both these airplanes are still in the air, and flew escort with the Vulcan at 1952's SBAC flying show.

Davies said that these planes paid their way; very few changes—none of them major ones—were made in the

ALOFT with the LEADERS*



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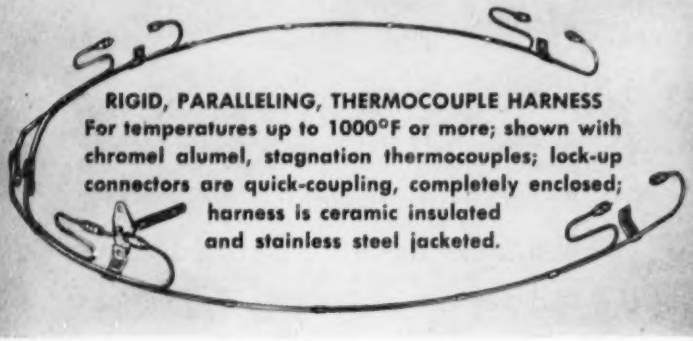

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698 as a result of test flights of the 707 series.

▶ **To the Bomber**—During 1948 most of the project group was involved with the hasty design of the 707, but some men were working on the big brother. By the end of 1949 the cockpit mock-up was completed. In the spring of 1950 the dimensions of the Type 698 were finalized, and the first starts were made in preparing a production line.

Now the work had really begun. About 100 technical designers worked out the specialized calculations which were part of the overall plan, and 200 draftsmen started the detail drawings.

In 28 months, the 698 was completely built. "That's really quite a short time in which to build a prototype of such a revolutionary aircraft," says Davies.

The Avro factory beat the time deadline for the 1952 SBAC show. On Aug. 30 that year the big bomber, with Roland Falk flying, lifted off the blacktop runway at Woodford, cleared the trees bordering the field and roared off over the hills of Cheshire.

A few days later it whistled above the runway at Farnborough, a white triangle contrasting with the brilliant blue 707B and orange 707A.

▶ **What Next**—Sir Roy Dobson, Avro's chief, has said that the company is working on a jet transport version of the Vulcan, in addition to its production effort on the bomber. There has been a lot of of informed criticism of a delta-wing transport, based on considerations of usable internal space and such. The best bet is that Avro would use the wing, plus a lengthened fuselage, to meet the passenger-storage needs of a transport.

Meantime, the first prototype is piling up flight time, and the second prototype is being completed at Avro's Chadderton plant. There is a good chance that the second Vulcan with Bristol Olympus engines for power will fly at Farnborough this fall.

Below its normal gross weight (as most big aircraft fly at Farnborough) and with 40,000 lb. of thrust to shove it through the sky, the second Vulcan should be one of the fastest planes in the air. With maximum gross weight (which might climb to 150,000 lb. before the plane gets into service) it should still be a first-class performer.

During the next couple of years, the Vulcan will face stiff competition from the Handley Page Victor and the Vickers Valiant or a later development of that plane.

The final outcome of the pending RAF evaluation of the three types can't be predicted now; but whatever it is, Avro's design team will always be credited with tackling a tough job, doing it well, and producing one of the world's outstanding aircraft.

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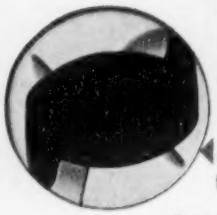

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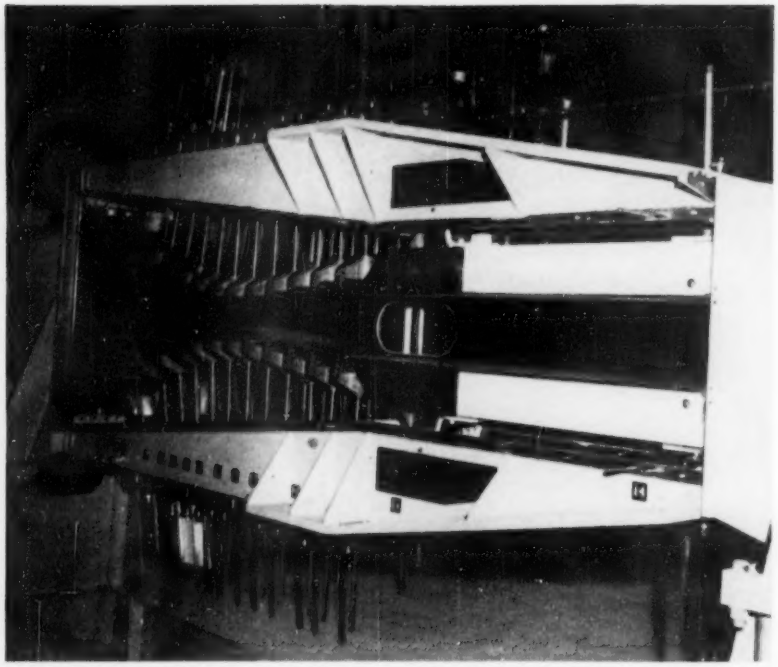


FLEXIBLE THROAT of Tunnel E-1, first operating test unit of the AF's Arnold Engineering Development Center, is operated by 24 jacks above and below nozzle strips.

Aro Gets 3,500-mph. Windtunnel

A 12-inch intermittent supersonic windtunnel, first test unit to be completed at the Air Force's Arnold Engineering Development Center, Tullahoma, Tenn., has been turned over to Aro, Inc., operating agency of AEDC.

The tunnel is capable of speeds between 1,000 and 3,500 mph. It is one of several such small tunnels included in the design of the Gas Dynamics Facility, which in turn is one of three major units comprising the center.

Tunnel test work will not begin for an estimated three months; the period until then will be spent in modification and calibration of the unit.

▶ **Basic Data**—Tunnel E-1, as the new test rig is designated, is an intermittent indraft type, where the air is drawn through the tunnel and into an evacuated sphere at the downstream end.

Test speeds are determined by the shape of the flexible nozzle formed upstream of the test section by a pair of metal strips. Contours of these strips are adjusted by means of a series of 24 jacks.

Currently, atmospheric air is used, passed through a temporary drier. Such a drier must be extremely large because it has to handle all the air as it passes into the tunnel. In contrast, a tunnel with upstream high-pressure storage—such as Tunnel E-1 will eventually have—can get away with a smaller and cheaper drier because the air can be dried as it is being stored. Storing, of course, takes place at a much slower rate than does using the air during a test.

▶ **History**—Design criteria were proposed by Aro in November 1950, and three months later were approved for construction. In June 1951, construction was expedited so that testing could be started earlier.

Test section of Tunnel E-1 is similar to that installed at the Jet Propulsion Laboratory of the California Institute of Technology, but the design has been modified by Aro to give a maximum speed almost twice that of the original.

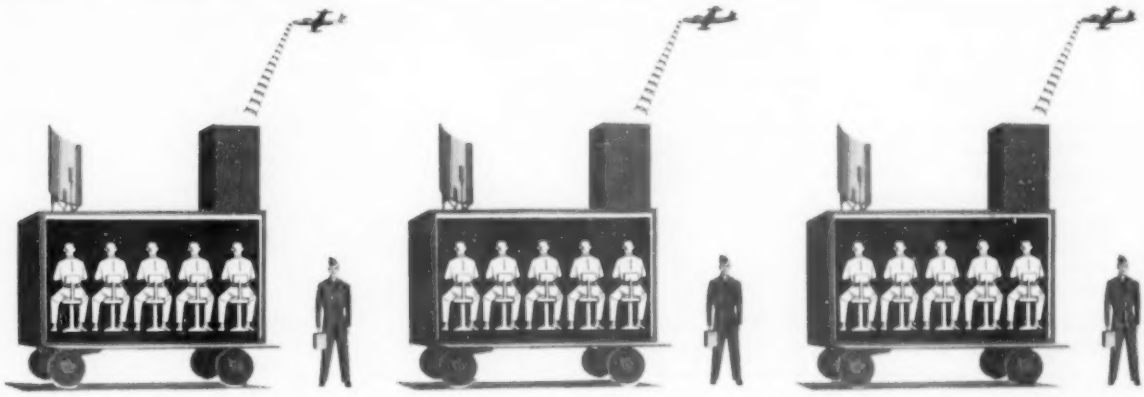
Total cost of this portion of the Gas Dynamics Facility is estimated at $470,000.

Women Engineers Give Merit Award

Elizabeth G. McGill, Canadian aeronautical engineering consultant, received the 1953 award for meritorious contribution to engineering from the Society of Women Engineers at its recent national convention in New York.

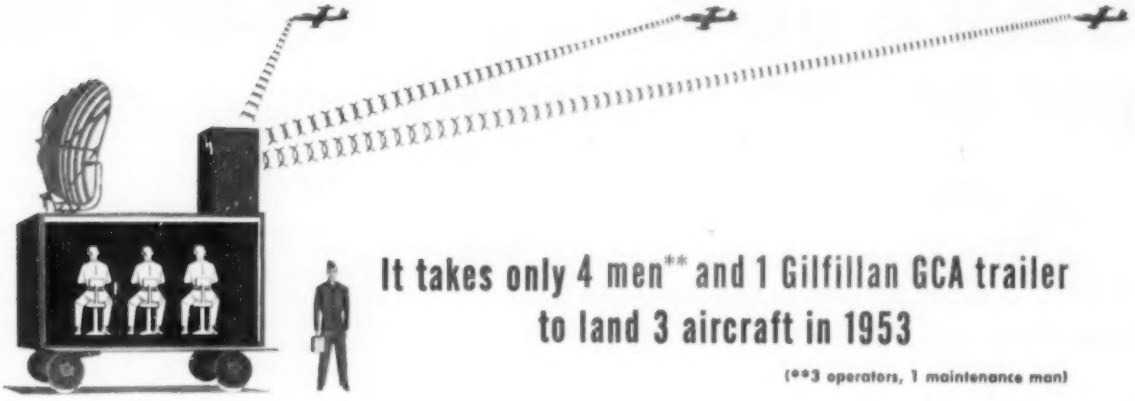
Miss McGill was chief aeronautical engineer for Canadian Car and Foundry Co. before the war, and during the war years was in charge of engineering for production of Hawker Hurricanes and Curtiss SB2C Helldivers built in Canada.

DISAPPEARED! 14 Men and 2 Gilfillan GCA Radar Trailers!



It took 18 men* and 3 Gilfillan GCA trailers to land 3 aircraft in 1943

(*15 operators, 3 maintenance men)



It takes only 4 men and 1 Gilfillan GCA trailer to land 3 aircraft in 1953**

(**3 operators, 1 maintenance man)

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THRUST & DRAG

Award of the Induced Drag Coefficient of the Week goes to the official industry publication which has just discovered the engineering shortage. AVIATION WEEK, apparently a bit closer to these issues than its contemporaries, has been preaching that gospel for some years now. We first reported a continuing need for engineers in a declining supply way back in January 1949. We conducted our own survey in May 1951 and concluded that the supply was low and dropping. We have presented (last December) the views of the Engineering Manpower Commission of the Engineers Joint Council for utilizing the available engineering supply. And as we said almost two years ago, "The basic fact is that an adequate supply of engineers does not exist and cannot be made to exist."

The same publication reports that the industry is going to use "intensive recruiting" as one possible out. Unless this should be read "pirating," I see little future in recruiting a non-existent group. We have scraped the bottom of the barrel. Now we've got to use the barrel itself.

* * *

Have you been keeping an eye on some of the recent designs turned out by the French? There seems to be a wealth of new ideas coming from Gallic drawing boards, and getting into the air in at least one prototype.

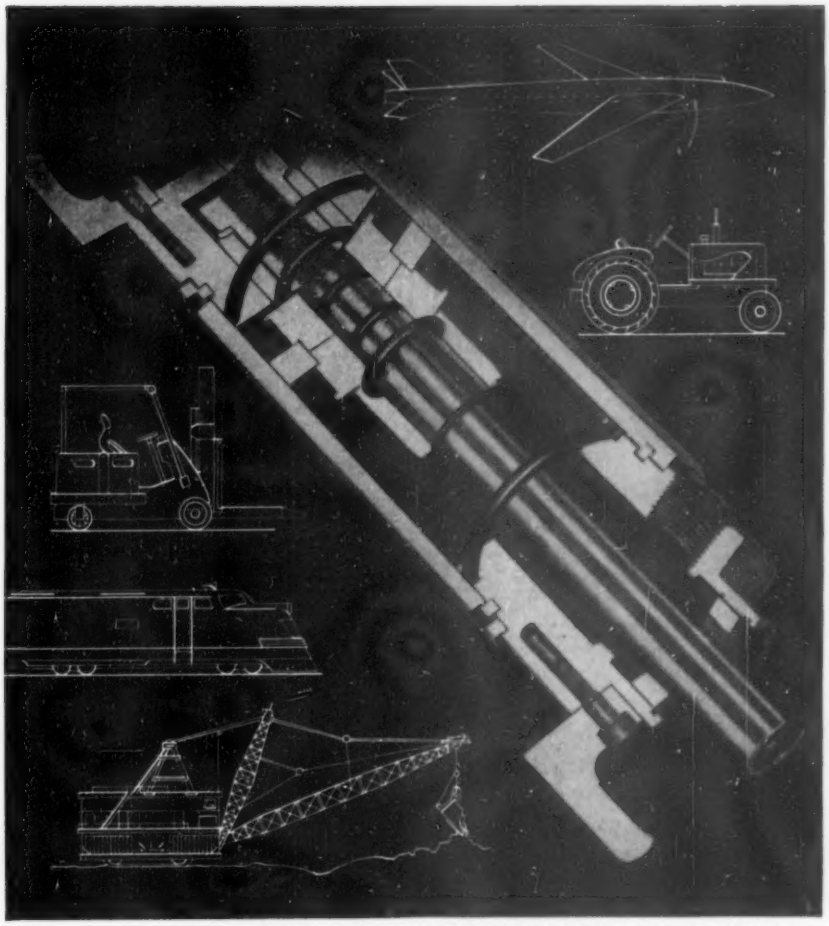
They've been flying the world's first pure ramjet airplane (Rene Leduc's 01 series); their recent Trident is a radical, lightweight rocket-powered fighter for Mach 1.5 speeds. They've gone supersonic in the Mystere, and reduced induced drag to a minimum in the Hurel-Dubois planes with their fantastic aspect ratios. They've flown ducted fan engines (Turbomeca) and a convertiplane. Besides all this, they've got some of the loveliest lightplanes to be seen anywhere.

It might pay some of the designers in this country to get a closer look at these novel French planes, and the Paris Air Show is coming up and France is lovely in June.

—DAA

Alloys Research

A special research project covering development of new wrought magnesium alloys is being handled for Wright Air Development Center, Dayton, Ohio, by Rensselaer Polytechnic Institute under direction of Ralph R. Nash, a member of the metallurgical engineering faculty. The project is scheduled to be completed Feb. 1, 1954.



Cutaway view of an Ortman Miller Machine Co. Standard Hydraulic Cylinder showing PARKER O-rings.

Specify PARKER O-rings for economical, leakproof seals

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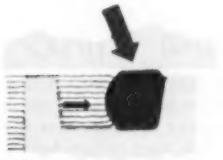

Cross section drawing of O-ring in groove, sealing under pressure.

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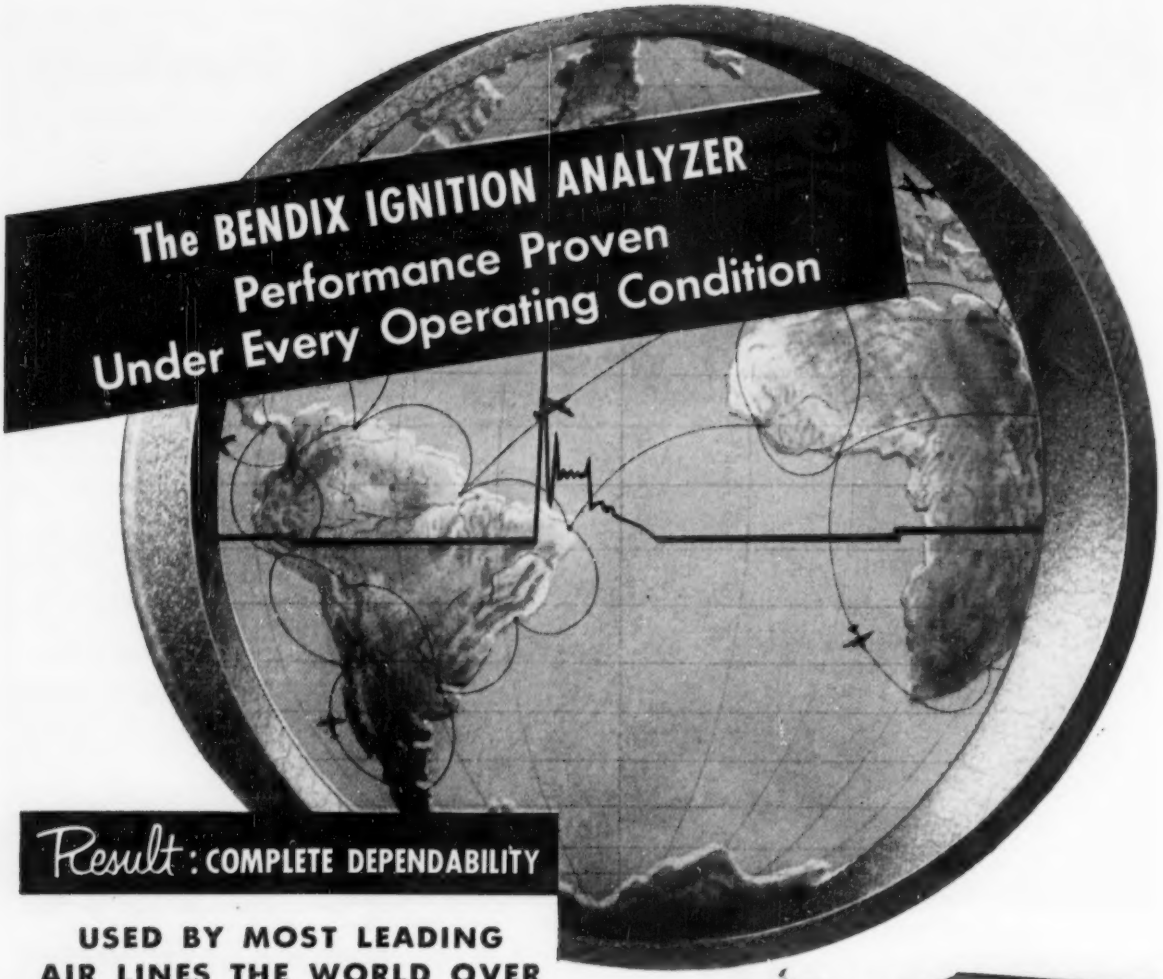

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Around the globe and around the clock, air-line operators have come to depend on the Bendix Ignition Analyzer as the guardian of their ignition systems.

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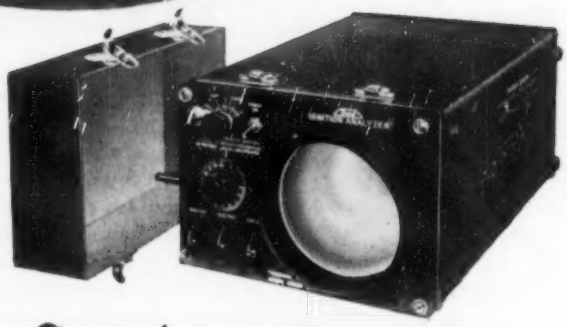
In fact, you will find there is no better investment in maximum safety and operating efficiency than a Bendix Ignition Analyzer for all your aircraft operations.

Detailing literature is available on request.



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The Bendix Ignition Analyzer is available for either airborne or portable-airborne installations. It can be used with either high or low tension magneto or battery ignition. It is the ignition analyzer that can predict spark plug failure before it occurs . . . make an efficient check of more than one spark plug at a time and do so on a large, easy-to-read screen . . . yet it costs less than comparable analyzers.

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Titanium Tests

- **Ryan studies new uses in aircraft structures.**
- **Trials include highspeed air-friction heating.**

Ryan Aeronautical Co. is studying new processing and application potentials of titanium and its alloys in sheet form for the Navy and Air Force.

For the Navy, the work will be to evaluate the material for aircraft structural applications. The Air Force contract is pointed to determine best production techniques for the sheet.

▶ **Navy Work**—Under the BuAer contract, Ryan is building various structural components which it will test under temperature and flight load conditions to obtain performance data for comparison with similar parts made up of aluminum alloy and steel. Components to be fabricated and evaluated will include:

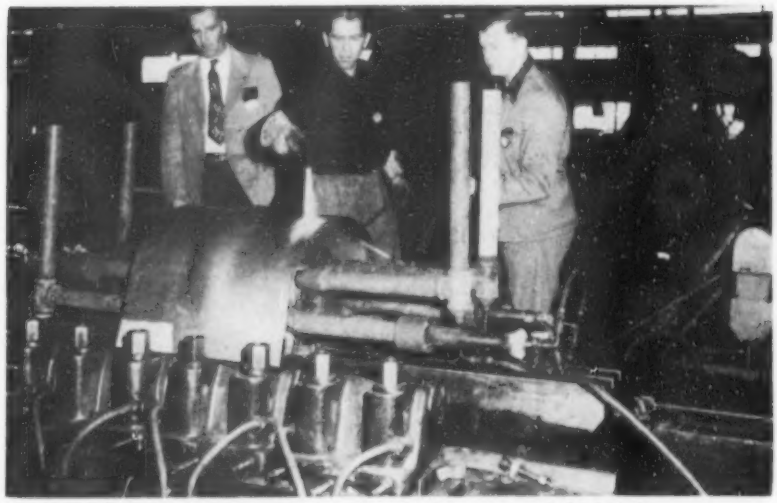
- **Airfoil section** which would be subjected to air-friction heating in a high-speed missile or other type of comparable aircraft.
- **Spar or bulkhead** component which would be located near the engine installation and thus be subjected to temperature effects.
- Plate-stringer combination located where temperature also is a factor.

▶ **Air Force Work**—Ryan's Air Force studies will check titanium and titanium-alloy sheet properties in these operations:

- **Cutting,** including sawing, shearing, blanking and grinding.
- **Forming** with punch press, drop hammer and rolling at various temperatures. Hand forming also will be studied.
- **Welding,** including fusion and all types of resistance welding.
- **Shop jobs** such as drilling, dimpling, riveting and cleaning.

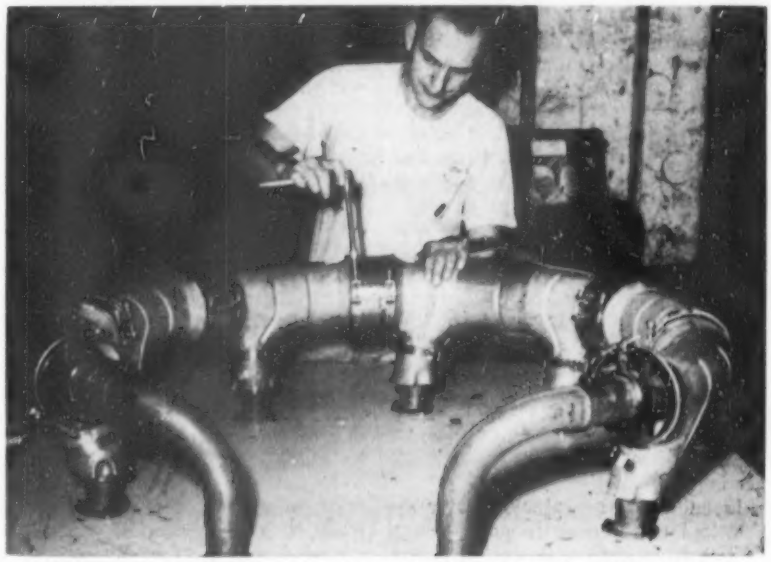
Phase two of this contract will include the production of a pilot run of parts embodying these processes. Ryan's development laboratory will test some of the parts under actual and simulated service conditions and will check such factors as embrittlement characteristics under exhaust gas exposure at various temperatures and galling and seizing in exhaust system, slip-joint and wearband applications.

▶ **Earlier Projects**—Titanium is not new to Ryan researchers. The company began study of the metal in 1951 at its own expense. It fabricated complex-shape exhaust-system-shrouds for the Piasecki HUP-1 and one of these components has been put through several hundred hours testing so that high-temperature effects could be analyzed.



TITANIUM sheet is formed on Ryan's Erco stretch press with heated die.

EXHAUST shroud sections made of the heat-resistant alloy are inspected, then . . .



ASSEMBLED for installation on "buried" engine used in Piasecki's HUP-1 copter.

GE HIGH-TEMPERATURE junction transistor (in boiling water, right) is part of small transmitter "picked up" by transistorized receiver (left).

IRE Convention Hears How . . .

New Transistors Beat the Heat

This may bring their avionics use closer; meeting also gets report of Arinc study on tube reliability.

By Philip Klass

Several new transistor developments of interest to avionics equipment designers made their debut at the recent national convention of the Institute of Radio Engineers in New York City. Among these were units with improved heat resistance and heat-dissipation properties.

Also of avionic interest was a quantitative report on military tube reliability, details of the new MIL specification for aircraft power supplies, a report on optimum antenna layouts in space-diversity communications systems, and disclosure of two new Air Force ground position navigation computers.

Attendance at the convention was 35,000, up 20% from last year.

▶ **Transistor Display**—A variety of "transistorized" equipment, most of it experimental, went on display in the Waldorf-Astoria in what was called "the first industry-wide transistor exhibit."

General Electric, Radio Corp. of America, Raytheon Mfg. Co., Bell Telephone Labs and the Signal Corps Engineering Labs participated.

Included in the exhibit were transistorized transmitters, receivers, a test oscillator, hearing aids, a telephone route selector, a video amplifier, a frequency meter, and a Geiger counter with a transistor power supply.

▶ **New Developments**—New transistor developments of special interest to the aviation industry included:

• **High-temperature transistor.** General Electric demonstrated its new "p-n-p" junction transistor which can be operated at temperatures as high as 100C. Previous transistor temperature limit of 70C or lower has hindered device's use in avionics equipment.

• **High-power transistor.** RCA engineers described two new techniques which increase a transistor's ability to dissipate internally generated heat and thereby permit a 10- to 20-fold increase in power rating.

• **Hybrid transistor.** A double-based p-n junction diode which exhibits useful control characteristics in certain types of circuits, such as a saw-tooth generator, was described by two GE engineers.

Bell Telephone Lab studies were reported which show that point-contact type transistor failures and "aging" are due to entrance of moisture and can be eliminated by improved hermetic sealing.

▶ **Of Aviation Interest**—Many of the more than 220 technical papers presented during the four-day convention had application to the aviation field. Of particular interest were papers which described:

• **Results of arinc tube reliability study,** based on analysis of tube failures in a variety of military equipment.

• **New MIL spec for power supplies,** from which avionics equipments will be operating in the future.

• **Results of space-diversity tests,** which indicate that 600 ft. is optimum antenna spacing for HF communications.

• **New A-1 and AN/APA-58 ground position indicators,** automatic dead reckoning computers for use in military aircraft.

▶ **High-Temp Transistor**—General Electric demonstrated the high-temperature characteristics of its new p-n-p junction transistor in a novel way. The transistor functioned as an oscillator in a small radio transmitter and was connected in such a way that the transistor was submerged in continuously boiling water (100C). A tape recorder played through the transistor transmitter and was picked up on a nearby transistorized table-model radio.

The new high-temperature transistor was developed by GE under military contract. Limited quantities of the new unit will be available in a few months, GE says, with mass production scheduled for this fall.

Although GE released no official performance data on the new device, a performance curve, presumably for the circuit under demonstration, drawn on the display backboard showed a total variation of power gain of less than 20% over a temperature range of —50C to 100C.

▶ **Cooling Transistors**—Dr. L. D. Armstrong of RCA described two new techniques which his company has developed to improve a transistor's internal heat dissipation, enabling it to operate at higher power levels.

• One method is to encase a noncapsulated transistor element in a tiny metal tank which has been filled with a cooling liquid. The liquid, which must have good dielectric properties and a high boiling point, circulates within the tank and transfers heat from the transistor element to the metal tank and then to the surrounding air.

• The other technique Dr. Armstrong described calls for putting the germanium element in a small metal case to which external cooling fins are attached. Internal heat is conducted from the wafer to the metal case through a solder connection and, in turn, radiated from the cooling fins.

Using these techniques, RCA says, transistors normally rated at about 0.05 watt can be operated at one watt without deterioration. If air and water is circulated around the metal case, units can be operated at up to three watts, RCA tests show.

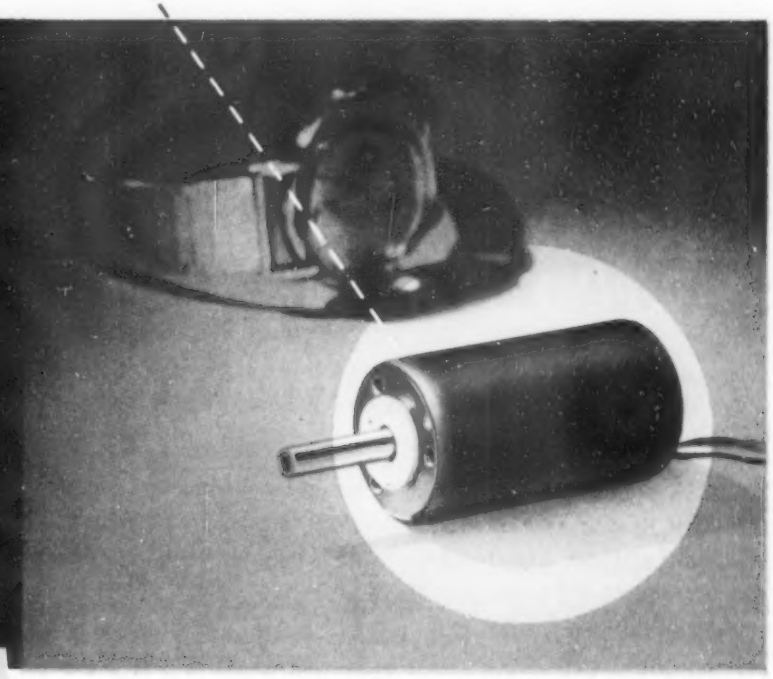
▶ **Hybrid Transistor**—Dr. I. A. Lesk of

"miniaturized"

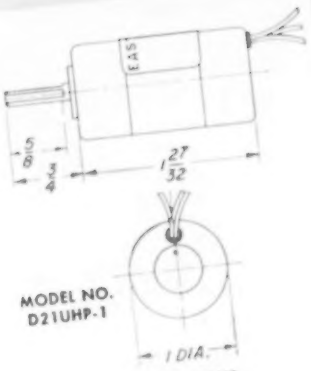
FOR MAXIMUM EFFICIENCY

EAD's

new versatile 1" motor



MODEL NO. D21UHP-1 (ACTUAL SIZE)



SPECIFICATIONS

Capacitor run induction motor, 115 volts, 400 cycles, single phase, 11,000 R.P.M., .1 Amp., 1/300th H.P., .1 MFD.-220 V., 35% efficiency, weight—3½ oz.

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APPROXIMATE R.P.M.	7,000	10,500	21,000
PHASES	1,2	1,2,3	1,2,3
INPUT VOLTAGE (MAXIMUM)	115	115	115

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HEAT DISSIPATION of RCA transistors is improved by sealing them in oil or mounting cooling fins on case.

TRANSISTORIZED video-amplifier (right) made by Bell Laboratories is not much larger than household match (left).

GE described a germanium diode with a double base which exhibits useful control characteristics if proper biasing is applied to the p-n junction.

Dr. Lesk described a saw-tooth generator constructed with a double-based diode which exhibited very linear characteristics from a few cycles per minute to several kilocycles per second.

► **Analyzing Transistor Failures**—The performance of up to 50% of certain types of early point-contact transistors had deteriorated beyond acceptable limits by the time they were put to use, Dr. R. M. Ryder of Bell Labs said. He described studies aimed at tracking down the cause of failure and shelf-life aging (AVIATION WEEK Nov. 24, 1952, p. 18).

Bell Lab analysis showed that moisture seeping through the plastic encapsulation was responsible both for slow deterioration and "sudden death" types of failure, Dr. Ryder said.

Sudden failures were caused by moisture warping the cat's whisker support,

Faith *in the sky*

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THE "SILK DRESS" BALLOON—Critically short of many essential materials and badly in need of an observation balloon, the Confederate Army was said to have fashioned a patchwork balloon from silk dresses contributed by Southern women.

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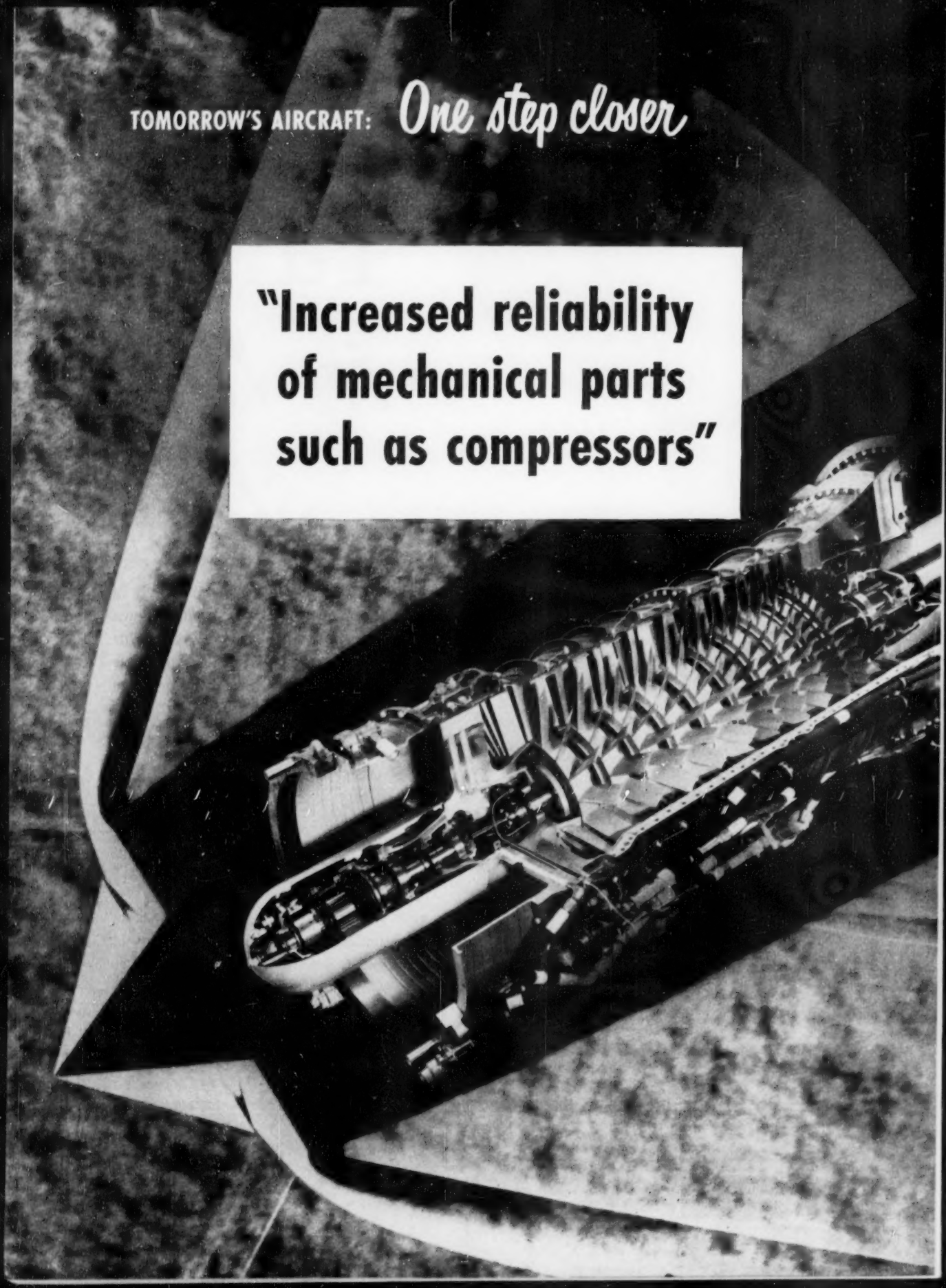
TOMORROW'S AIRCRAFT: *One step closer*

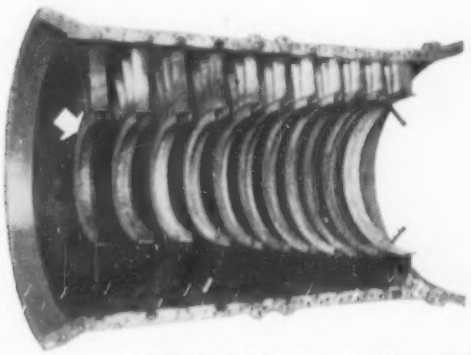
"Increased reliability of mechanical parts such as compressors"



Westinghouse early recognized the need for extra reliability of compressor stationary diaphragms. Today, Westinghouse stands first for their contribution in stationary or stator blade design and construction. How well they have developed a thoroughly dependable shrouded steel stationary blading on the compressor is dramatically demonstrated by Banshee performance over Korea. For the fact is . . . there has not been a single operational loss of the Banshee (with Westinghouse J-34 turbojet engines) because of stator blade damage. Breakage at this point would be serious of course, ripping out all the other blades in the compressor. Westinghouse construction avoids a complete break, the blades may bend if hit, but won't tear out . . . both ends hold tight to the shroud.

Lighter, more durable jet engines, like the powerful, new J-40 which recently passed the Defense Department's grueling 150-hour qualification test, will aid our country's defense. Though other jet aircraft problems remain to be solved, Westinghouse axial-flow design, proved over Korea, points the way to the solution of future jet fighter and transport problems.

Westinghouse is investing millions of dollars and man-hours to help build American jet-propulsion leadership. Jet engines are produced at South Philadelphia and Kansas City plants by Westinghouse, America's Jet Engine Pioneer. J-91002-A



Shown above is one half of the stationary element of a Westinghouse jet engine compressor. It consists of steel-fabricated diaphragms assembled in machined grooves in a cast aluminum housing. The white arrow above indicates one of the inner steel support shrouds.

THE SCOPE OF WESTINGHOUSE IN AVIATION

Basic aircraft systems

Turbojet Engines, Fire Control, Radar, Autopilots, Communication Equipment and Electrical Systems.

Ground equipment

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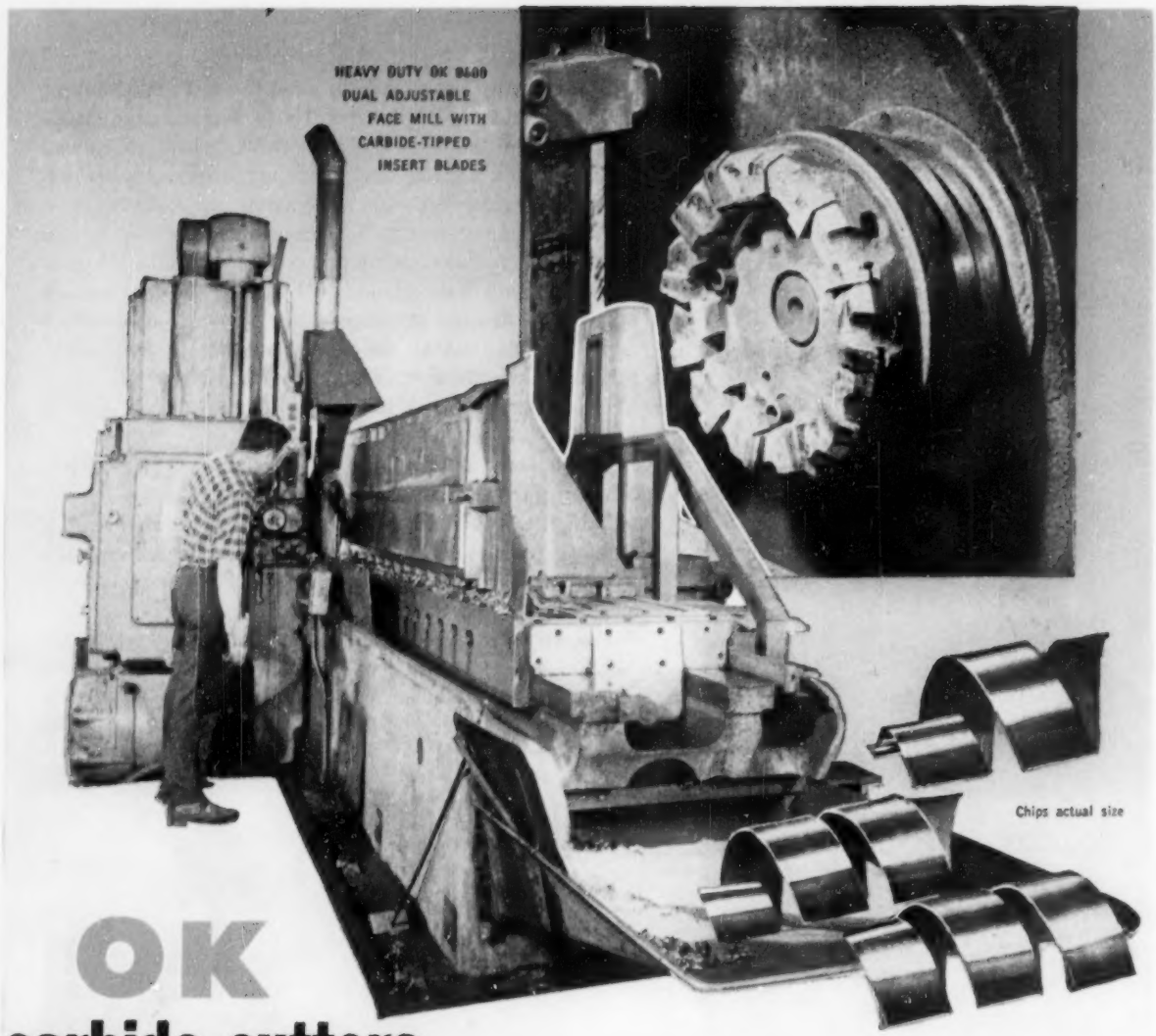

OK carbide cutters

make short work of taper-milling chrome-moly prop blades for B-36 Bombers at Curtiss-Wright Caldwell plant

Here is a good example of how progressive management speeds up heavy milling operations with carbide cutters. The machine is a high powered planer-type miller with mechanical feed and magnetic chuck. The cutter is a heavy duty OK 8600 dual adjustable carbide face mill. Work pieces are tough chrome-molybdenum steel 25" x 123" x .800" for C-W hollow propeller blades for famous B-36 Intercontinental Bombers. Each plate is taper milled for a distance of 107 inches, above and below center rib, the depth of cut increasing from zero to .390 inches. The lower half is milled on the forward stroke and the upper half is milled on the reverse stroke, at the rate of 23 inches per minute. A movie of this operation dramatically shows chips piling on the magnetic chuck and presto! . . . they drop when chuck is demagnetized.

OK carbide milling cutters are built for solid performances like this. They have the strength of simple construction – two-piece body and wedge-shape blades. Mating serrations insure blade security and provide for blade advancement to compensate for wear. No locks, wedges or screws weaken or mar the streamline design. With more beef in the body, OK cutters can better stand the terrific pressures of modern high speed milling.

If you have a milling problem, you should have OK catalog 13. An OK engineer will be glad to give the benefit of our experience over the past 50 years.

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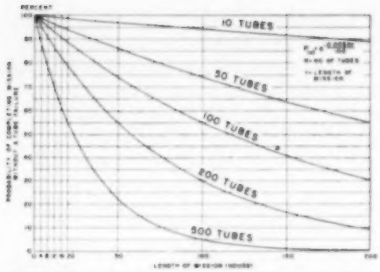
THE OK TOOL COMPANY, Milford, New Hampshire



ARINC analysis shows probability of plane completing a mission without a tube failure.

thereby displacing the whisker from its correct position, Dr. Ryder said. He urged complete hermetic sealing as the solution to transistor reliability problems.

► **Alloy Transistors**—RCA's Dr. D. A. Jenny described a new n-p-n type transistor made with an alloying process in which the alloy contains the donor impurity necessary for transistor operation. (RCA had earlier applied the alloy process to a p-n-p type transistor.)

Advantage of the alloying process, according to Dr. Jenny, is that it overcomes differential expansion strains between the donor impurity element and the germanium normally introduced during cooling. The new process gives essentially a planar junction, producing transistors with power gains of over 50 db., according to Dr. Jenny.

The complementary characteristics of n-p-n and p-n-p junction transistors, and their application to circuits, including a novel audio amplifier which requires no resistors, capacitors, or output transformer, were described by G. C. Szikali of RCA in a paper entitled "Symmetrical Properties of Transistors and Their Application."

► **Transistor Measurements**—Devices designed to measure transistor characteristics were described or displayed at the IRE convention. The following items were included:

• **Alpha sweeper.** This instrument, suitable for use by non-technical personnel, displays current gain (alpha) versus emitter current characteristics on an oscilloscope. By varying collector voltage, complete families of characteristic curves can be obtained, H. G. Follingstad of Bell Telephone Labs said in describing the device.

• **Alphabetameter.** This device, which measures transistor current gain, was developed by the Electronic Instruments Div. of Burroughs Adding Machine Co. and was displayed for the first time at the IRE convention.

► **Arinc Reports on Tube Reliability**—Standard JAN-type tubes suffer a reasonably constant failure rate of about 0.6% per hundred hours, excluding the initially high failure rate which occurs during the first 20 to 50 hours of use, E. F. Jahr of Aeronautical Radio, Inc.

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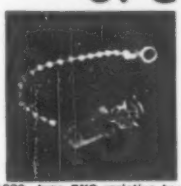
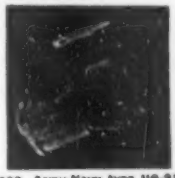
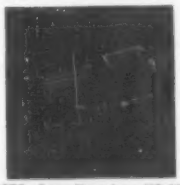


AI-11039, type BNC resistive termination plug. Weatherproof. Styrene Copolymer insert. Neoprene rubber gasket. Can be furnished with any desired impedance.

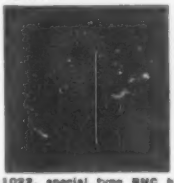


AI-11072, Army-Navy type UG-21D/U, improved type N plug for use with RG-8, 9, 9A, 10/U cables. Weatherproof. Teflon insert, neoprene mating seal gasket, silicon rubber cable clamp gasket.



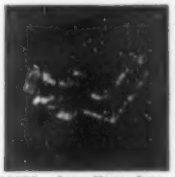
AI-11070, Army-Navy type UG-154/U, type LC plug for use with RG-17, 18/U cables. Weatherproof. Silicon rubber gaskets.

AI-11032, Army-Navy type UG-37A/U, high voltage pulse receptacle pressurized. Ceramic insert, neoprene rubber gaskets.



AI-11022, special type BNC high voltage plug. Mates only with high voltage receptacles and jacks, for use with RG-59/U cable. Weatherproof. Teflon insert. Neoprene rubber gaskets.

AI-11006, Army-Navy type UG-385/U Klystron Coupler. Weatherproof. Styrene Copolymer and linen base bakelite inserts. For use with klystron tube 726C.



AI-11030, Army-Navy type UG-306/U, type BNC right angle adapter. One male, one female end. Weatherproof. Teflon inserts. Neoprene rubber gasket.

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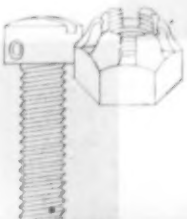

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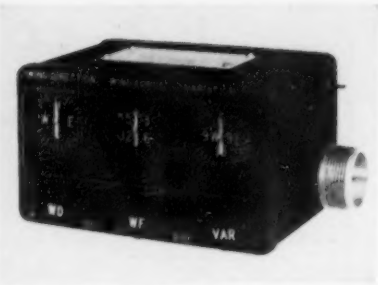

CONTROL BOX of new ground position indicator developed for USAF by Ford Instrument Co. When pilot sets in wind direction, velocity, and magnetic variation . . .

PANEL INDICATOR gives him continuous indication of latitude and longitude.

reported to the IRE.

Based on limited data, new improved tube types (ruggedized tubes) appear to have only half the failure rate of JAN tubes, Jahr noted.

These observations are based on the preliminary results of a controlled tube-reliability analysis which Arinc is making under military contract.

Arinc keeps a detailed record on each of 42,000 tubes used in special military equipment, from the time the tube is installed until it is removed for test or because of failure. Once removed, tubes are returned to Arinc in Washington for test and examination to determine the specific cause of failure.

Approximately 85% of the 42,000 tubes under controlled-test are standard JAN types; the remainder are the new ruggedized tube types, both military and Arinc. The 0.6% failure rate for JAN tubes is considered valid only out to 500 hours, Jahr cautioned, because of insufficient data beyond that point at the present time.

On the basis of present data, Arinc has developed a set of curves to show the probability of completing a mission depending upon the number of (JAN) tubes on board and the length of the mission (see chart, p. 49).

For example, the curves indicate that an airplane whose avionic equipment uses a total of 500 tubes has an 80% probability of completing an eight-hour mission without tube failure. (The B-36 reportedly uses 2,100 vacuum tubes and the B-47 probably has about half that number.)

▶ **Semi-Controlled Tests**—Arinc is also conducting a larger-scale semi-controlled tube analysis program for the military in which no attempt is made to keep track of tube life before failure. The purpose of this test is to determine general causes of failure, a comparison of failure rates for different tube types, and the relative effects of tube environment on tube failures.

All vacuum tubes removed from equipment at eight military bases (three Air Force, two Navy, and three Army) and at Convair's missile plant, are placed in envelopes on which the maintenance personnel identify the specific equipment, chassis, and tube socket from which the tube came. They also note on the envelope the apparent tube defect, estimated time in use, and any other available information.

Arinc representatives at each base collect the envelopes daily and test the tubes on a Hickok 539A, noting their findings. Every week a list of removed tubes and pertinent information on each is sent to Arinc headquarters in Washington where the data is recorded on IBM cards for ease of analysis.

▶ **Semi-Controlled Test Results**—An Arinc analysis of 14,110 removed tubes in the semi-controlled program makes the following breakdown of cause:

- 37% **mechanical failure** (such as envelope defects, loose supports, defective filament or heater, and shorts).
- 27% **electrical failure** (such as low mutual conductance and plate current).
- 36% **no apparent failure** (in Arinc tests).

Arinc analysis also showed that tubes used in aircraft equipment suffered approximately twice as many mechanical failures and only roughly half as many electrical failures as tubes used in fixed installations.

▶ **Other Observations**—The semi-controlled and controlled test programs have served to pinpoint shortcomings of some individual tube types. Examples:

- **6AR6 tubes** suffered more electrical failures and fewer mechanical failures than other tube types.
- **832A tubes** suffered four times as many failures due to broken glass as the average of all other tubes in semi-controlled tests.
- **1641 tubes** suffered a high percentage of failures due to fragile anode seal structure.
- **6AG7, 6SN7GT, 6C4, and 12AU7 tubes** showed considerable susceptibility to the formation of cathode interface impedance.

Jahr cited two different equipments which both used two 1Z2 rectifier tubes. One equipment suffered a total of twenty-five 1Z2 tube failures, whereas the other had none. Investigation showed that the manufacturer of the first equipment had failed to use the

Stung by the tail of a scorpion . . .

Stung by the tail of a scorpion
Gravity loosens its grip
On the hide of a hellion
Who scorches the sky
Through a curve of silence
While sound is a laggard
In the tangled air.

The monster with open mouth
Sucks food from runnels of light
Washing blue space
Through a furious gut.

Tiptoe on the flattened world
The watchers are asking their eyes
If a dragon that swallows flame
Can burrow a hole
In the sagging roof of the morning.

Upon a ladder of smoke
The monster touches the zenith
But gravity roused from its spell
Reaches toward rafters of sunlight
And drags the scorpion down
To a crevice of earth.

Jet Plane— from "Incident in Silver", by A. M. Sullivan *(by permission)*.

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Transmitters	AY201-1	26V, 400~, 1 ph.	225	1.25	25+j115	11.8	9.5	3.5	15
	AY201-4	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	20
Receivers	AY201-2	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	45
Control Transformers	AY201-3	From Trans. Autosyn	Dependent Upon Circuit Design				42.0	10.8	15
	AY201-5	From Trans. Autosyn	Dependent Upon Circuit Design				250.0	63.0	15
Resolvers	AY221-3	26V, 400~, 1 ph.	60	0.35	108+j425	11.8	53.0	12.5	20
	AY241-5	1V, 30~, 1 ph.	3.7	—	240+j130	0.34	239.0	180.0	40
Differentials	AY231-3	From Trans. Autosyn	Dependent Upon Circuit Design				14.0	10.8	20

**Also includes High Frequency Resolvers designed for use up to 100KC (AY251-24)

AY-500 (PYGMY) SERIES

Transmitters	AY503-4	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	25.0	10.5	24
Receivers	AY503-2	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	23.0	10.5	90
Control Transformers	AY503-3	From Trans. Autosyn	Dependent Upon Circuit Design				170.0	45.0	24
	AY503-5	From Trans. Autosyn	Dependent Upon Circuit Design				550.0	188.0	30
Resolvers	AY523-3	26V, 400~, 1 ph.	45	0.5	290+j490	11.8	210.0	42.0	30
	AY543-5	26V, 400~, 1 ph.	9	0.1	900+j2200	11.8	560.0	165.0	30
Differentials	AY533-3	From Trans. Autosyn	Dependent Upon Circuit Design				45.0	93.0	30

For detailed information, write to Dept. H.

ECLIPSE-PIONEER DIVISION of Bendix AVIATION CORPORATION
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prescribed series impedance in the plate circuit of the tube, Jahr said.

Jahr also concluded from present data that the greatest "infant mortality" rate on tubes usually occurs within the first 20 hours and may run as high as 15%. Preliminary indications are that "infant mortality" is higher in aircraft than in fixed installations or on shipboard, Jahr noted.

He also remarked that receiving-type tubes have a lower failure rate than transmitting tubes.

▶ **Future Power Supplies**—Practically all of the military aircraft of the future will generate 400-cycle a.c. as the ship's primary power, although 28-v. d.c. systems will not go out of the picture completely for some time yet, G. W. Sherman of the USAF's Wright Air Development Center told the IRE.

Variable-frequency a.c. primary power supplies are on the way out, Sherman indicated, as a result of improved constant-speed drives and the advent of the small air-turbine alternator drives.

Sherman presented highlights of the recently adopted MIL-E-7894 spec which spells out military requirements for aircraft power generation systems. He warned avionics designers that in the future they must design equipments requiring more than 500 va. of a.c. power to operate from a three-phase source. This is intended to provide reasonably balanced three-phase alternator loads.

The new spec provides for an allowable frequency range of 380-to-420 cps., and an allowable voltage variation of 102 to 124 v., Sherman said. Eventually, the military hopes to tighten the voltage regulation limits to 108 to 121, but Sherman warned equipment engineers not to count on these limits in present designs.

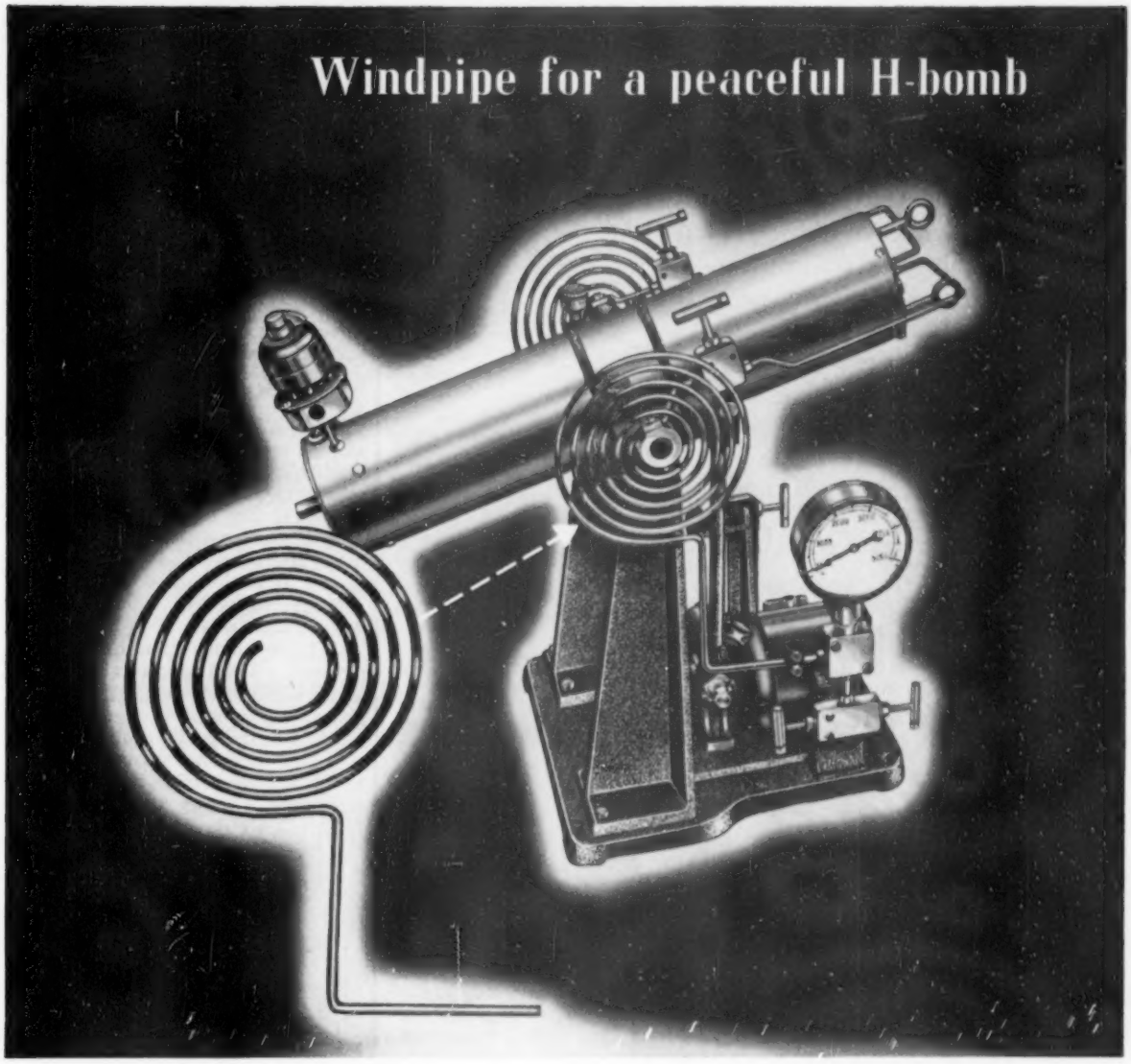
▶ **Calls for System Mock-Ups**—Sherman called on aircraft manufacturers to construct a complete mock-up of their electrical systems prior to building a new airplane. He also urged avionic manufacturers to test their devices with the same electrical power source used in the plane.

(At present, many companies use commercial 400-cps. power supplies which frequently have better waveform and regulation than aircraft power supplies.)

Sherman also warned avionics engineers that their equipment must be able to withstand short exposures to low frequency (150 cps.) power when supplied from an engine-driven alternator at such times as engine speed falls below the operating range of the constant-speed drive.

▶ **Space-Diversity Tests**—Optimum spacing between two space-diversity system antennas operating in the HF band is

Windpipe for a peaceful H-bomb



You can call it an H-bomb if you like. Some people do. Technically, it *is* a hydrogenation bomb or, simply, a super-pressure vessel. Uses for it are legion but not warlike.

Researchers in rubber, plastics, pharmaceuticals, petroleum, and solvents pilot their hydrogenation, oxo-reaction, polymerization and other jaw-breaker problems in its gizzard—under high pressure.

To speed-up chemical reactions, the vessel is rocked 38 times a minute. Pressurizing a see-sawing chamber is in itself a neat trick: when pressures of the order of 60,000 p.s.i. are required you might become discouraged or concerned.

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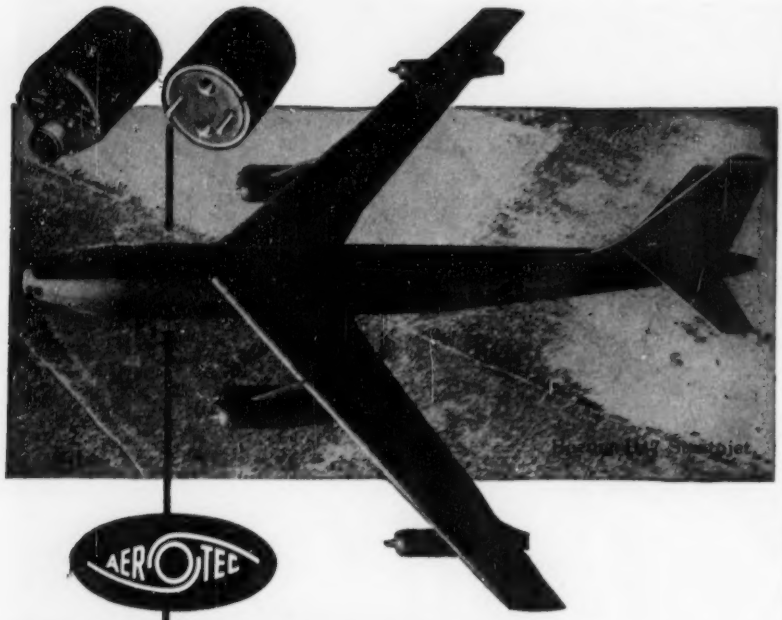

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600 ft., M. Acker of the Signal Corps Engineering Labs told the IRE. (A space-diversity system is one which uses two physically displaced antennas to obtain maximum signal strength and reduce random fading.)

Acker's conclusion was drawn from joint Signal Corps-Washington University tests which also indicated that space-diversity systems give better performance than frequency-diversion systems. (Frequency division uses simultaneous broadcasting on two or more radio carrier frequencies.)

The Signal Corps experimented with half-wave horizontal dipole antenna spacings of up to 2,400 ft., with radio transmission distances of up to 2,200 miles.

Test results showed that the antennas may be oriented either parallel or perpendicular to the direction of the signal with comparable results when 600-ft. antenna spacing is used, Acker reported. The parallel orientation gives slightly better performance at 600 ft., and should be used when conditions limit antenna spacings to 400 ft. or less, Acker said.

A triple-antenna space diversity system, with a 300-ft. spacing, gives slightly better performance than a two-antenna system, Acker noted.

Based on frequency diversity system tests using frequency separations of 170 to 1,870 cycles, Acker concluded that "frequency diversity at its best is inferior to space diversity systems" in the HF region.

► **A-1 Ground Position Indicator**—A new 46-lb. navigational computer designed to give military aircraft pilots a continuous indication of their latitude and longitude was described by J. L. Dennis of the Wright Air Development Center.

Developed by Ford Instrument Co., the device requires the pilot manually to set in his starting latitude, longitude, wind direction and velocity, and magnetic variation. The A-1 then continuously computes airplane position from the plane's true airspeed and magnetic heading, which are fed in automatically.

The device's instrumental error is one percent of the distance traveled, Dennis reported. Operational errors run higher because of unknown variations in wind velocity and direction. However, Dennis said, a six-hour WADC flight test showed an overall computer error of only 3% using a six-hour wind prediction.

Dennis also described briefly a new AN/APA-58 ground-position computer developed by Eclipse-Pioneer Division of Bendix Aviation. The device operates in conjunction with the AN/APS-42 navigational radar. The latitude and longitude of the destination are set into the computer and cross hairs, generated by the computer, appear on the APS-42

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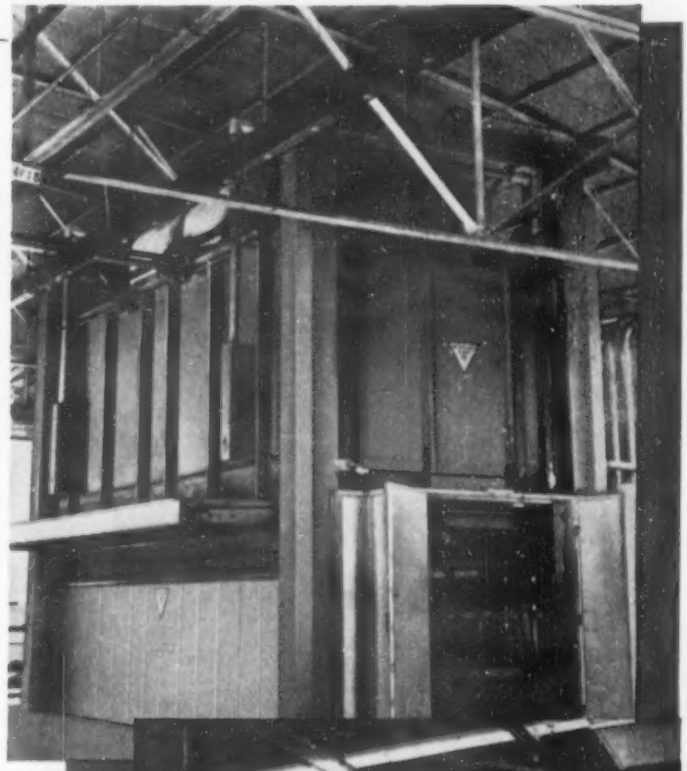

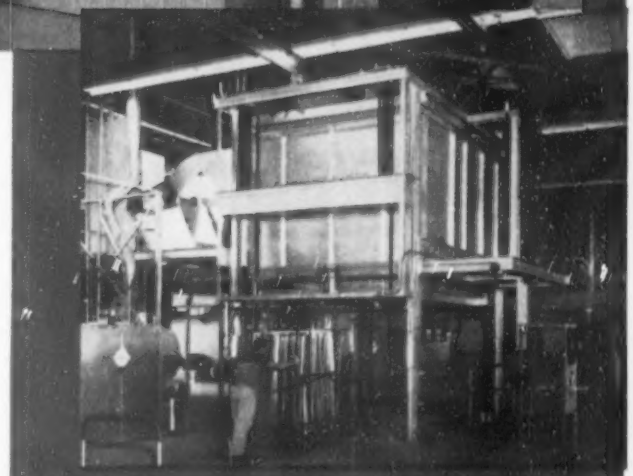

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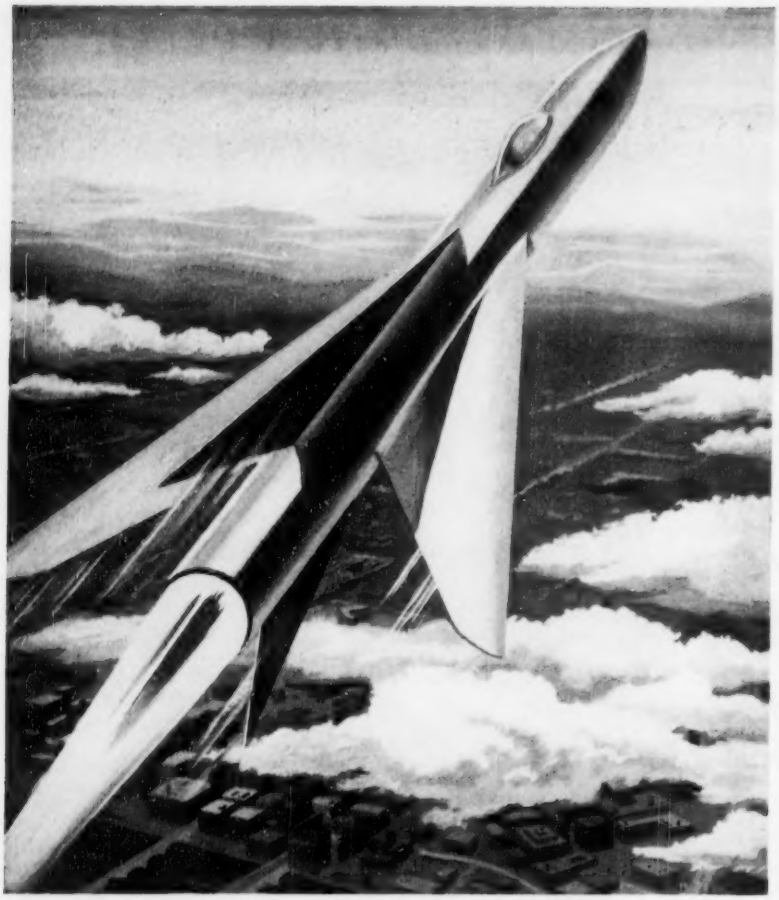

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radar scope to show airplane position relative to the destination.

Dennis emphasized that the AN/APA-58 computer is highly subminiaturized, with 75 of its 85 tubes being of the subminiature variety. He also noted that there had been no submin tube failures in almost 1,000 hours of computer operation.

▶ **Novel Avionic Exhibit**—Judging from the crowds surrounding the Westinghouse Electric Co. booth at the convention, its plywood "rocket interceptor" was one of the most novel displays in the Grand Central Palace. The stubby plywood plane was outfitted with a much-simplified, non-classified version of the Westinghouse radar fire control system now seeing use in Korea on the Douglas F3D Skyknight.

Visitors had the opportunity to test their shooting eye by maneuvering the airplane controls to keep a target blip centered in a radar scope. When the operator squeezed a trigger he scored hits only if the blip was centered on the radar scope. Outside a small totalizing device added up the hits scored.

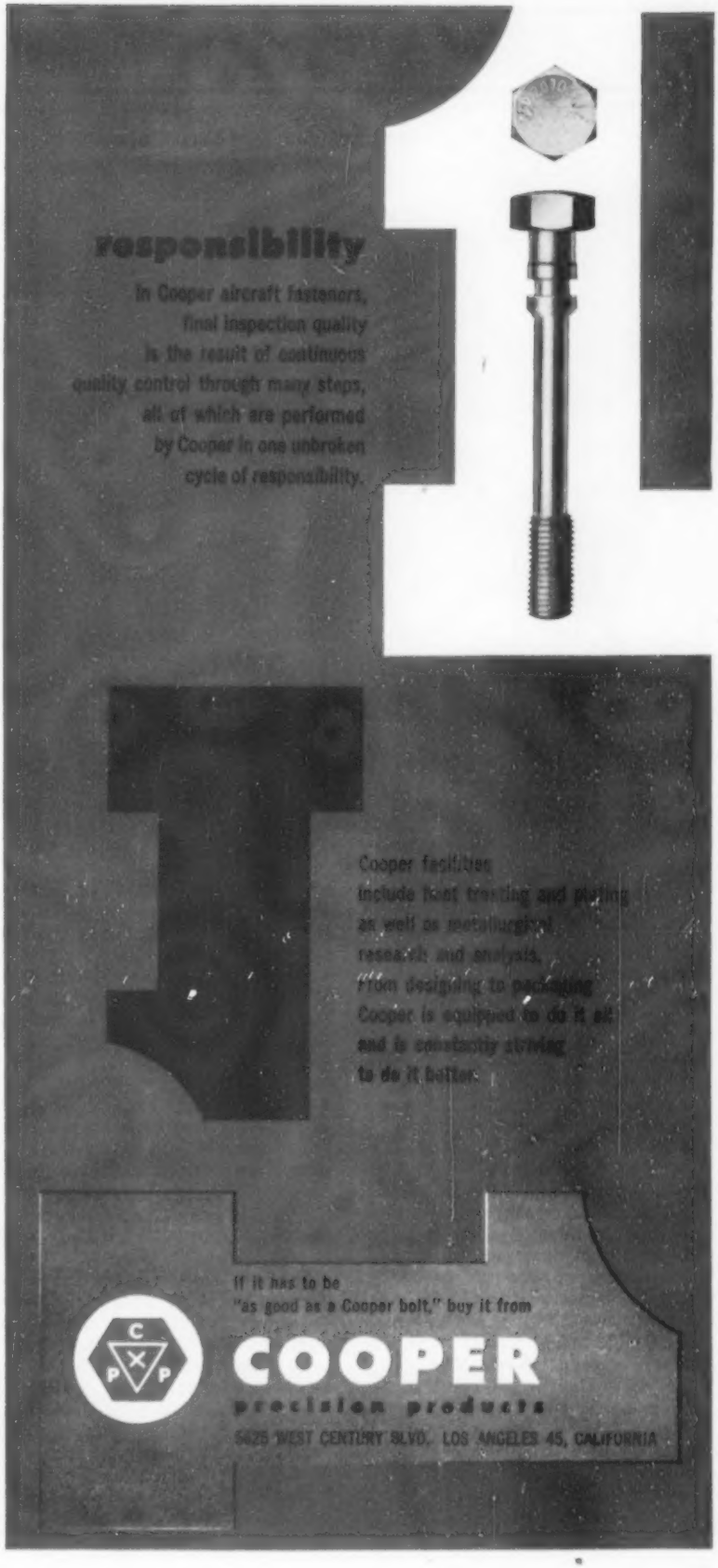
▶ **Convention Record**—All available technical papers presented at the 1953 IRE convention will be published soon in a new publication called the "1953 Convention Record." The Record will be divided into ten parts, with each part devoted to one general subject, i.e. Radar & Telemetry, Antennas & Communications.

Members of IRE professional groups will receive free a copy of that part of the Convention Record pertaining to their group's activities. Other parts of the Convention Record may be purchased at a nominal charge.

Details and prices can be obtained by writing the Institute of Radio Engineers, 1 East 79th St., New York 21, N. Y.

NEW LIMA ILS

"Most modern instrument landing system in Latin America," is what Panagra calls its new ILS, recently commissioned at the Lima, Peru, airport. Localizer beam for new ILS is generated by this antenna array which was installed under contract with Corpac (Peruvian Airport and Commercial Aviation Corp.). New ILS will reduce minimums to 200-ft. ceiling with one-half-mile visibility.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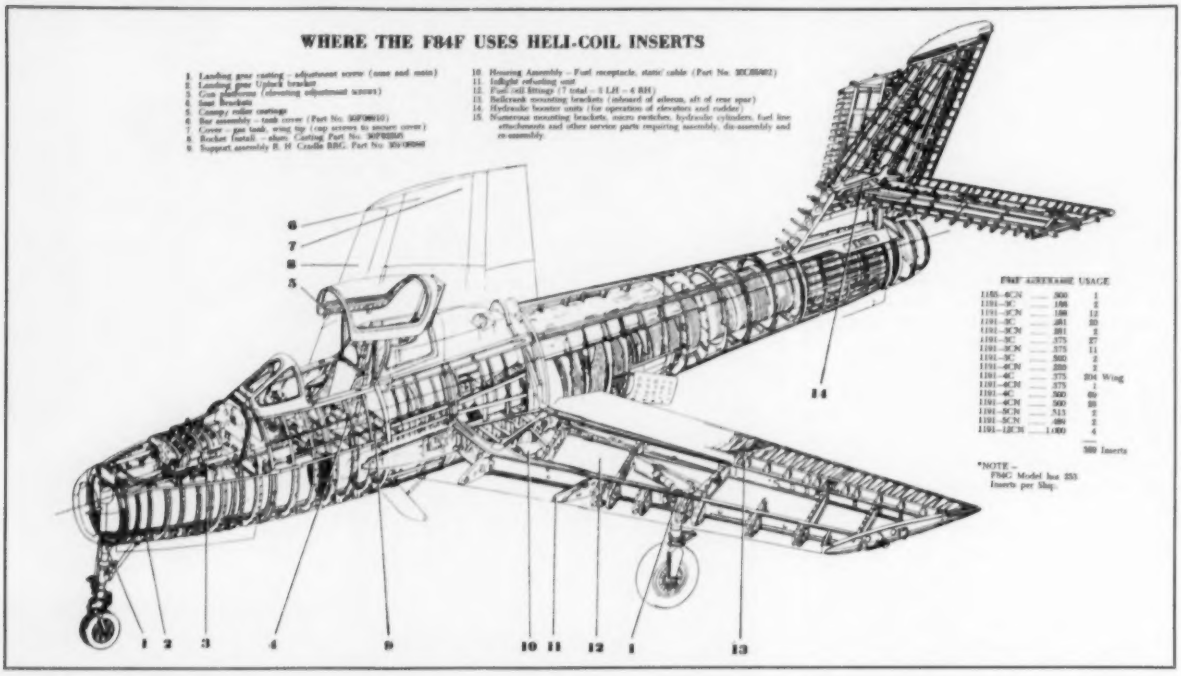

Thread Inserts Protect New Jets

Growing use of 'soft' light metals such as aluminum and magnesium opens way for Heli-Coil applications.

By George L. Christian

Danbury, Conn.—Tiny metal coils that protect hole threads may not sound glamorous.

But they are playing an increasingly important part in strengthening aircraft structures, and saving weight, space and money. Tapped threads in light metals and plastics have been a troublesome detail to designers and manufacturers. The threads have been subject to wear, seizure and corrosion.

One modern sweptwing fighter, the Republic F-84F, uses 389 patented Heli-Coil inserts; another uses 253. And tests are being conducted with Heli-Coil-equipped aluminum nuts in the wing and empennage of Boeing's speedy B-47 Stratojet bomber. If successful, such an installation will reportedly mean considerable weight savings for the airframe (AVIATION WEEK Mar. 30, p. 11).

Because of the airframe manufacturers' trend to put more beef into their planes by using large forgings and extrusions of soft metals (aluminum and magnesium) in place of built-up sheet metal assemblies, the future of such inserts seems assured.

▶ **More on Turbojets**—The insert is also gaining favor in jet engine uses, say Heli-Coil officials. They cite these examples:

• **Westinghouse** can save $16.20 per J40-WE-22 by replacing compressor stator bushings with Heli-Coil inserts. And the company's J40 and J46 engines use two to three times as many inserts as the older J34.

• **General Electric** has jumped its use of Heli-Coils four to five times in the J73 over the J47. In the forward frame alone the number of inserts has climbed from approximately 50 to 306.

• **Allison** increased the number of Heli-Coils from a total of 61 in the J35-A-27 to 193 units in the J35-A-35.

• **Another major axial-flow turbojet** engine can save $17.44 per engine ($8.98 in material savings plus $8.46 labor savings) by using 85 Heli-Coils instead of solid screw thread bushings with serrated lock rings. This is for gear box housing component applications. Weight saving adds up to five pounds. Cost saving for the entire engine would be $200, Heli-Coil says.

▶ **Missiles Too**—Heli-Coil inserts are proving useful on guided missiles too, according to Paul E. Wolfe, who is the firm's director of project engineering.

Heli-Coils are used on the Nike, designed and developed by Western Electric and manufactured by the Douglas Aircraft Co. Wolfe said the inserts are used to facilitate the periodic removal and re-installation of equipment which requires inspection and testing during long storage periods.

▶ **Reciprocating Engines**—An old but important use of Heli-Coil inserts is in sparkplug openings in reciprocating engines. Wolfe pointed out that Pratt & Whitney Aircraft pioneered this use of the insert and, today, is its largest user on reciprocating engines. He listed these principal advantages for Heli-Coils in plug openings:

• **Weight and space** required for aluminum-bronze solid inserts were saved.

• **Heat dissipation was improved,** prolonging plug life and reducing detonation.

• **Cementing of plugs** in their holes through high heat and carbon deposits was eliminated because smooth insert threads allowed plugs to be removed and replaced several times.

▶ **What It Is**—Heli-Coil inserts are "precision-formed coils of stainless steel or phosphor bronze which fit between the tapped female thread and the screw thread of the stud or bolt." Stainless steel meets Aircraft Material Specification 7245A and phosphor bronze meets AMS 7247A.

The steel inserts are made of 18-8

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Address correspondence to

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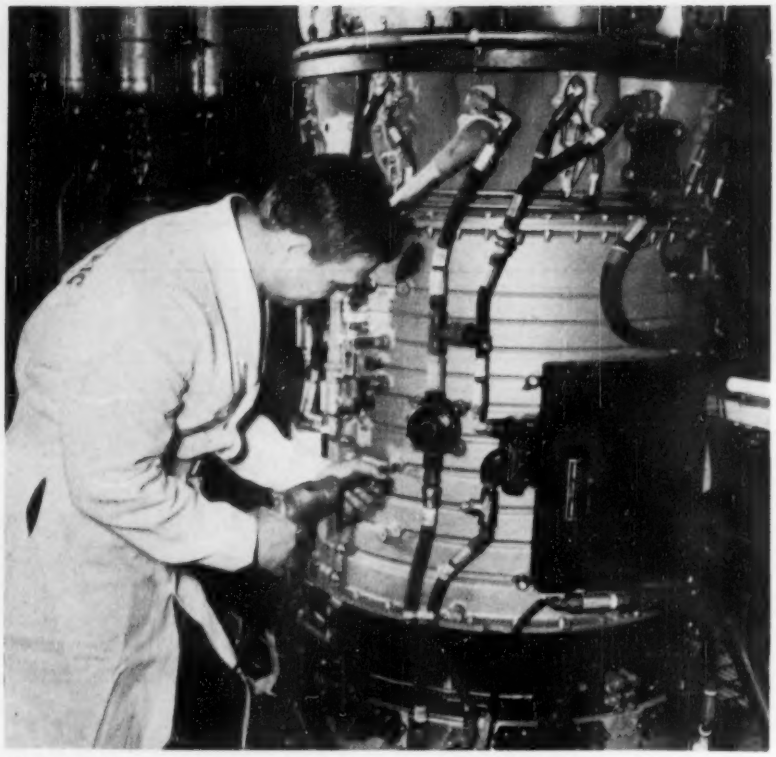


GE J47-E25 jet engine uses more than 350 stainless steel Heli-Coil inserts.

stainless steel wire having an ultimate tensile strength of 180,000 psi. This is how the inserts stack up on a Rockwell "C" scale:

- Socket-head screws ..35-37 (actual test).
- Aircraft specification screws .....26-32 (AN-B-3C).
- Ordinary bolts and screws .....0-7 (screw stock).
- Heli-Coil insert .....43-50 (actual test).

Heli-Coil inserts are easy to install. Simply drill a hole, tap it, insert the Heli-Coil, and break off the tang at the bottom, the company says. Heli-Coil inserts automatically lock themselves in place.

A special notch in the last coil of the insert facilitates breaking the tang. Blind holes do not require tang removal and unnotched inserts cost 10% less than notched ones. The Heli-Coil insert is said to be easy to remove. A special tool zips out an old insert in a matter of minutes without damaging threads in the original assembly, to permit installation of a new insert, the company says.

Heli-Coil inserts are available in the widest range of thread sizes applicable to the aviation and avionic industries,

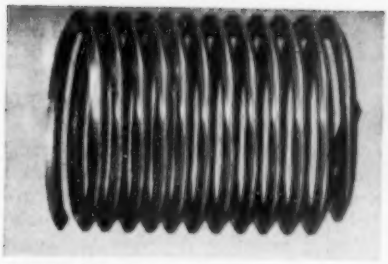
Heli-Coil Saving Study*

JET ENGINE GEAR BOX HOUSING

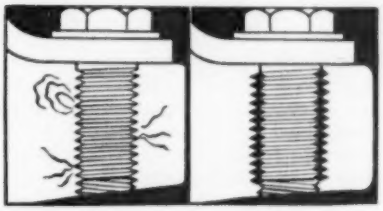
Part	No. of Inserts	Material Savings	Labor Savings	Total Savings
A/C Accessories	17(A)	$1.785	$1.693	$3.478
	2(B)	.218	.199	.417
Auxiliaries	16(A)	1.680	1.593	3.273
	9(B)	.981	.896	1.877
Bevel Drive	19(A)	1.995	1.892	3.887
	0(B)	.....	.....	.....
Oil Pump	12(A)	1.260	1.195	2.455
	2(B)	.218	.199	.417
Power Take Off	8(A)	.840	.796	1.636
	0(B)	.....	.....	.....
Savings for Each Size		7.560(A)	7.169(A)	14.729(A)
		1.417(B)	1.294(B)	2.711(B)
TOTAL SAVINGS PER GEARBOX		$8.977	$8.463	$17.44

(A) 10/32X2-in.-dia. H-C Inserts (B) 1/4X2-in.-dia. H-C Inserts

**From survey prepared by Heli-Coil engineering department on comparative cost of Heli-Coil thread insert vs. solid screw thread bushing with serrated locking ring. APPLICATION: gearbox housing components of a classified axial-flow jet engine.*



HELI-COIL thread inserts are made of high-strength 18-8 stainless steel wire.



SKETCH shows how Heli-Coil insert (right) reduces effect of thread strains.

according to a major airframe manufacturer. The inserts are designed for National Coarse and Fine Thread Series, Unified Thread Series, straight and taper pipe threads and automotive and aviation sparkplug threads. Heli-Coil inserts are made in all standard sizes and lengths. They are available for Class 2, 2B, 3 and 3B fits.

▶ **Manufacturer's Survey**—Other conclusions reached by the airframe manufacturer, who conducted a threaded insert survey comparing Heli-Coil to three other types of inserts were:

- Less edge distance is required by Heli-Coil inserts than by the other three. Result is weight saving on detail parts.
- Evenly distributed stress concentrations on bolts used with Heli-Coil inserts means less thread failures at thread runout.
- Lightest in weight of the four inserts.
- Material cost of Heli-Coil inserts was the lowest of the group.

Immediate availability of Heli-Coils proved to be a desirable factor.

▶ **What It Does**—Heli-Coil engineers told AVIATION WEEK that the inserts offer these advantages to the design engineer:

- **Weight and space saving.** Smaller boss diameters, smaller, shorter and fewer cap screws, smaller flanges all mean smaller, lighter forgings or extrusions. Cost and weight of bushings is greatly reduced.
- **Wear saving.** Extra hard, stainless steel inserts protect against galling corrosion, seizure or electrolysis between threads.
- **Money saving.** Because Heli-Coil inserts are considerably harder than the cap screws which fit into them (cap screw ultimate tensile strength is 125,000 psi. min.; Heli-Coil wire is 180,000 psi. min.), if damage occurs, it is the

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cap screw that suffers, not the insert. So cap screw, whose cost is negligible, is replaced, not the insert assembly.

Example of this saving involves Boeing B-47 Stratojet's fuel cell fittings. Originally fitted with dome nut-type solid bushings with an ultimate tensile strength of 80,000-90,000 psi., the $20 fittings must be scrapped if bushings are damaged by the tougher cap screws, according to Heli-Coil engineers. If the fittings are equipped with H-C inserts, their 180,000-psi. tensile strength prevents such damage and resultant junking of the fitting.

The project is under consideration by Boeing and U. S. Rubber Co.

▶ **Smooth Finish**—Heli-Coil engineers stressed the smooth, almost glassy-like surface of their inserts. The 8-15 micro-inch finish put on Heli-Coil inserts means these advantages, according to company engineers:

• **Less seizure** due to excessive heat or carbon deposits is likely to occur.

• **Greater tightness.** Gliding action provided to bolt or screw means less torque dissipation because of thread drag. Result is much more even distribution of stresses through the entire length of the screw instead of concentration in the first two or three threads. This gives a Heli-Coil assembly considerably greater strength than a conventional assembly, company officials say. Heli-Coil engineers cite this example of the increased clamping effect due to Heli-Coil smoothness:

In a standard female threaded assembly requiring 140 in./lb. torque, 70-80 in./lb. is dissipated due to thread drag, leaving only 60-70 in./lb. for clamping effect. Standard AN cap screws are finished to 30-50 micro-inches. In a Heli-Coil-equipped female threaded assembly requiring the same 140 in./lb., only 5-10 in./lb. is lost through thread drag, leaving 130-135 in./lb. for clamping effect. This is without imposing additional stresses on cap screw or stud, Heli-Coil says.

▶ **In Service**—Important advantage of Heli-Coil insert-equipped accessories is that they may be disassembled and reassembled many times without damage to the female threads, the company says. Even if the insert's threads are damaged, it may be removed and replaced in a matter of minutes by the use of simple tools provided by Heli-Coil.

Such ease of servicing assemblies in the field with a minimum of special or cumbersome tools is proving to be a boon to military and commercial users of the inserts, Heli-Coil says.

▶ **Bullseye**—Company spokesmen cite these interests of Heli-Coil Corp. as "the bullseye and next two rings in our marketing program":

• **Original equipment.** The company aims to have Heli-Coil inserts incorporated in original equipment at the design stage. To this end, Heli-Coil engineers are prepared to make exhaustive and complete comparative engineering and cost studies showing the material and labor savings to be obtained from using Heli-Coil inserts.

Among other benefits claimed are those from a production angle: Prime designers and manufacturers can save themselves time and production costs of making bushings by substituting Heli-Coils. Bushing production facilities can then be diverted to other efforts.

• **Production salvage.** Heli-Coil inserts can be used to salvage production errors in tapping threads. Assemblies may quickly be salvaged by using the insert.

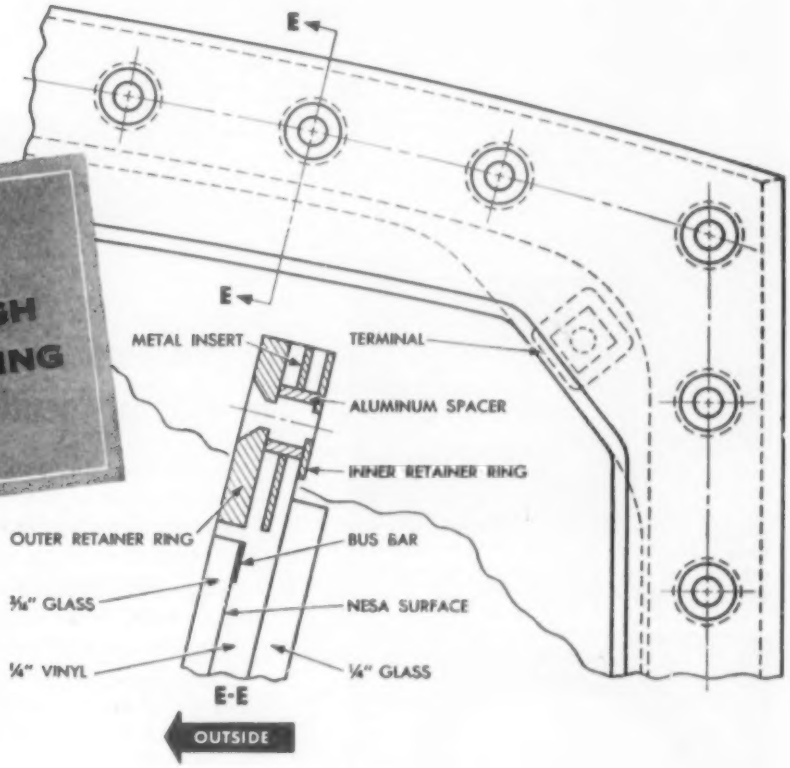
• **After-market operation.** Use of Heli-Coils on aircraft after they have gone into service is the next target. Used primarily on engines and accessories, Heli-Coils are helpful in preventive maintenance and repair.

Heli-Coil inserts are said to be particularly useful when screws or bolts have to be used with such soft materials as plastics and wood. Additional benefit is derived from use with moulded plastic, where insert is moulded right into the plastic form, eliminating all machining operations

How electrically-heated "NESA" Glass is used in windshields of Convair-Liner 340

A report from

THE PITTSBURGH AIRCRAFT GLAZING FILE



PREVENTION of ice formation, freedom from fogging and frost, and maximum resistance to bird impact are designed into the windshields of the Convair-Liner 340 through the use of electrically-heated NESA-coated Glass.

These sections show you how Convair engineers and Pittsburgh Plate Glass Company technical representatives, working together, applied NESA Glass to the windshields. The "direct-view" (DV) window on the pilot side is NESA, too.

The NESA windshield consists of two pieces of tempered glass with a vinyl filler between. The inboard surface of the outboard glass is NESA coated and carries electrical current at relatively low resistance between bus bars and terminal. Heat dissipation is about 1,500 BTU/hour/square foot.

Pressure load is carried by the full-tempered inboard glass by transmittal through the vinyl to the outboard retainer ring, leaving the semi-tempered NESA Glass "free-floating" with as little stress as possible. Gentle warming of the plastic by the NESA coating imparts maximum bird resistance to the windshield.

Pittsburgh technical representatives will be glad to assist you with your aircraft glass or glazing problems, drawing upon experience gained in working closely with most of the nation's major aircraft companies. For complete information, write to Pittsburgh Plate Glass Company, Room 3246, 632 Fort Duquesne Blvd., Pittsburgh 22, Pa.

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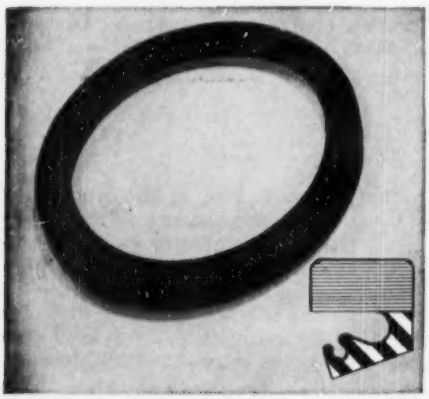
J-M Clipper Seals fly with the Sikorsky HO5S helicopter...

Clipper Seal being installed in the intermediate gear box of the Sikorsky HO5S helicopter to seal oil in, keep abrasives out.



Photograph and cross section of Type LPD Clipper Seal. This is just one of numerous styles available to solve tough sealing problems.

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To retain the lubricants vital to its complex rotor and gear systems . . . and to protect bearings against the infiltration of abrasives . . . the new Sikorsky HO5S helicopter depends on these positive sealing qualities of Johns-Manville Clipper Seals.

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Clipper Seals are corrosion-resistant—The molded body is entirely non-metallic, is therefore unaffected by electrolysis and most forms of corrosion. And the garter spring is available in various corrosion-resistant metals.

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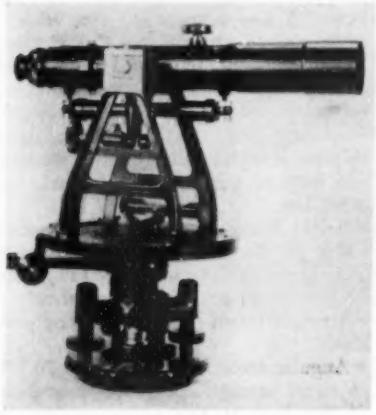
such as drilling and tapping.

▶ **The Future**—Heli-Coil inserts started as Aero-Thread inserts, invented by Harold Caminez, an aeronautical engineer. Distinguished by a pear-shaped cross section, Aero-Thread inserts were used widely during World War II. Special shape proved to be a handicap because special thread forms on cap screws were required. So cross section was changed to diamond shape to accept conventional male threads and name was changed to Heli-Coil.

Heli-Coil Corp. moved in mid-1951 to Danbury, where it built a plant of 35,000 sq. ft. area. But increasing business has compelled the company to add 15,000 ft. more space, nearing completion and already partly occupied.

Original company had six employes and produced $50,000 worth of products in its first year. In 1952, the company employed 123 in the shop, 84 office personnel and 75 engineering representatives scattered throughout the U. S. and Canada. In the same year, Heli-Coil sold millions of its inserts plus thousands of taps, tools and gages.



Optical Tooling Scope

The Optoplane, a telescopic transit designed expressly for jig and fixture location and alignment in assembly plants, has been developed by W. & L. E. Gurley. Accessories such as this for speedy optical tooling are becoming an increasingly familiar sight on aircraft production lines.

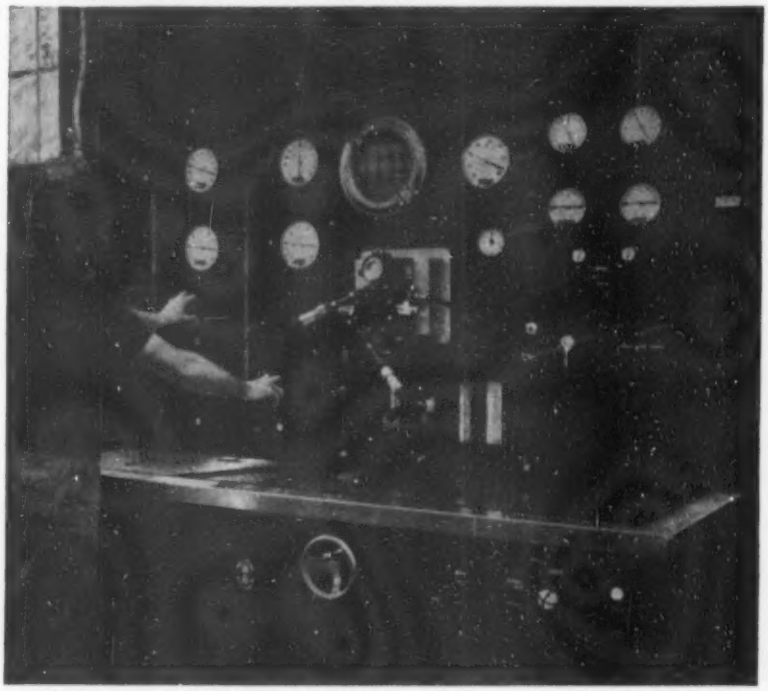
This unit was developed with the help of aircraft tooling engineers, according to the firm, and permits jig alignment and coordination within a few thousandths of an inch. It establishes the horizontal and vertical planes required to locate jigs for sectional assembly operations.

The Optoplane's telescope is the erecting type with a 1.31-in. aperture, providing 22X magnification. Resolution is 4 seconds and field of view 1.3 degrees. It will focus to a minimum of 3 ft.

W. & L. E. Gurley, Troy, N. Y.

GREER TOPICS

Important News of Greer Equipment for Aviation and Industry



GREER LUBE PUMP TEST STAND supplies oil under rigid control conditions of temperature, flows to 10 gpm, pressures to 28 psi, and pump shaft speeds to 5000 rpm. It accurately checks the main oil pump assembly of the J-65 turbojet engine for the Wright Aeronautical Division, Curtiss-Wright Corp.

Greer Builds Complex Lube Pump Tester for Wright Aeronautical

Precision engineered from ten pages of rigid specifications to accurately test main oil pump assembly of J-65 turbojet engine

The test machine pictured above is another good example of Greer designed-to-order equipment. In this case, the customer provided specifications—in other cases, the entire test problem is turned over to Greer engineers who design and build precision equipment to do a specific job.

These out-of-ordinary problems need good men to solve them. There are *good* men at Greer with many years of this specialized experience that is difficult to find, perhaps impossible to match elsewhere.

Greer makes many standard test machines, too, that can be ordered right out of a catalog (a free copy sent on request). Though we call them standard machines, they are not mass-produced; each machine is slowly and painstakingly created, repeatedly tested for accuracy and dependability.

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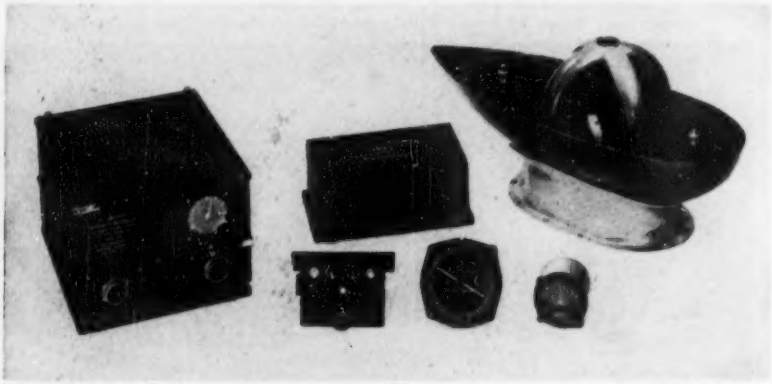


COMPONENTS of Gavco's prototype low-frequency automatic direction finder include twin-loop antenna (right). Production ADF is to weigh about 30 lb.

Static Doesn't Bother New ADF

Twin-loop antenna enables unit to use low-frequency's long range with no sacrifice in homing accuracy.

By Scott H. Reiniger

A low-frequency automatic direction finder (ADF) for airline transports and smaller craft, designed to overcome static problems associated with LF equipment and line-of-sight limitations of VHF sets, is being readied for production by Gavco Corp., a subsidiary of General Aviation Corp.

The 100-1,000-kc. equipment is undergoing evaluation tests at the Signal Corp.'s Army Aviation Center at Monmouth County Airport, N. J., and a prototype is to be exhibited at the Aviation Trade Show slated for June 9-11 at the Hotel Statler, New York. It also is scheduled for service trials by a major overseas airline.

Production units are expected to weigh about 30 lb.—light enough for small Army "Jeep" planes—and to be priced competitively with other airline ADFs.

▶ **New Double Loop**—A patented "double-loop" antenna (not found in other sets) and a new sensing antenna arrangement are said to make this ADF virtually static-free, enabling it to home consistently with an accuracy of one degree, Gavco says.

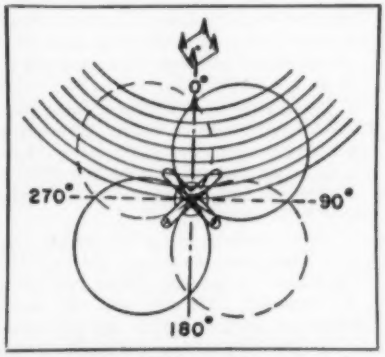
Comparison tests in extremely rough weather show the equipment can hold to a suitable homing indication where other LFs provide no usable indication at all, Gavco reports. Its advantage over VHF equipment lies in its capacity to utilize the low-flying and long-range features of low-frequency transmission, while retaining high dependability and an accuracy at least as great as that of shorter-range VHF, in the company's view. This makes it applicable to airline use, especially so in overseas operations where LF has a greater reach from shore than VHF.

Principles embodied in the set are intended to overcome LF shortcomings at their source, not simply alleviate them by better shielding and other piecemeal measures, Gavco says. The company thinks the design approach reflected in the set will help blow new life into LF radio navigation, now outpaced by VHF.

The development is timely, as airlines have been exhibiting a somewhat renewed interest in LF lately, the company notes.

The big difference between this ADF and others is the use of the double- or crossed-loop antenna; the single-loop is the system commonly used.

Instead of rotating the loop to a null (no signal) point for homing, the Gavco system drives its twin loops to a point of nearly maximum signal strength, where static is most easily overcome.



RANGE STATION beam bisects angle between loops of Gavco ADF antenna.

▶ **Avoiding the Dilemma**—The dilemma of the single loop, as Gavco expresses it, is that the point of strongest signal covers too great an area directionally to be used for pinpointing with sufficient accuracy an LF range station, while the point of no signal (null) provides a closer indication, but can be most easily confused by static.

The twin loop neatly circumvents these problems, Gavco says. It rejects both the use of the null point and the point of strongest signal for homing, but operates in the general area of strong signal, to overcome static problems. It seeks for a point where the signal to each of the loops is equal.

The loops are mounted perpendicular to each other, on the same shaft, driven by a brushless servo motor. Signals from the range station are picked up equally by each antenna when the direction of the incoming signals bisects the 90-deg. angle between the loops. A line intersecting this 90-deg. angle points straight to the station.

The arm of each loop is displaced 45 deg. from this homing point and receives a signal 70.7% of maximum. Any movement of the antenna from this point upsets the balance, causing one loop to pick up more signal, the other less.

▶ **Better Because . . .**—Among reasons given by Gavco for greater accuracy and dependability of the twin-loop, 70.7% signal strength arrangement:

• **Stronger signal** more easily overcomes static.

• **Angular sensitivity** is great at 70.7% of signal strength. A given movement of the loop at this point produces a greater voltage change than at peak signal strength. A characteristic loop phase pattern curve slopes more sharply in the 70.7% area than at the peak of the curve.

• **Twin loops magnify displacement** from homing point. As one loop moves closer to the peak and increases voltage output to its circuit, the other moves farther away and reduces its output, widening the voltage gap. Thus, the system voltage change is the sum of the total of the changes in each of the loop circuits. Difference in loop outputs can be seen on twin needles of a cross-pointer indicator which must have equal inputs to cross each other at the centerline.

The Gavco system depends on amplitude comparison, rather than phase reversal, for homing. The loop drive motor stops when the voltage difference is zero.

▶ **Sensing Antenna**—Another major departure in this ADF is momentary in-

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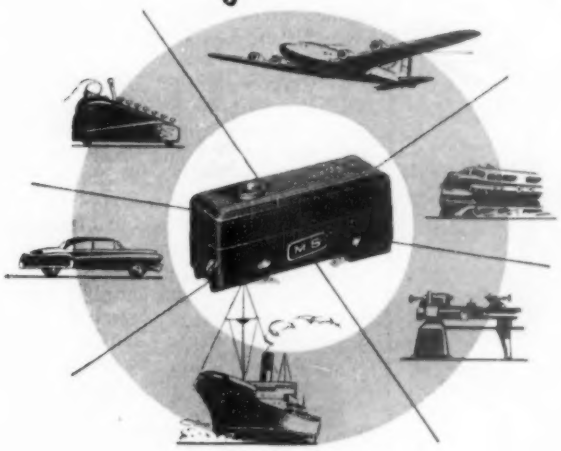
the vision of research scientists is brought to usable reality by the design engineer working with the MICRO Switch engineer



THE dreams now taking form in the minds of research scientists will become the realities of tomorrow.

Who would have realized that the study of cosmic rays would bring about the Atomic Age? Only a few years ago, skeptics ridiculed the prediction of supersonic speeds. In the last election, people were amazed at the accuracy and speed of electronic calculators.

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These few brief case histories indicate the degree to which design engineers are convinced that the "use of a MICRO switch is a principle of good design."

* * * *

When you stroll to the diner from your seat on a modern streamlined train, more often than not it is a MICRO switch that opens the heavy door at the touch of your hand. One of the largest makers of these door-opening devices for railroad cars, buses and street cars took advantage of MICRO'S ability to provide small packaged switch assemblies to perform this function. These assemblies eliminated difficult maintenance problems, were easily replaced . . . and opened the doors better.

* * * *

There's a new dictating machine in the market so small that it can be carried in the hand and fits into a brief case. Use of two ultra-small MICRO "subminiature" switches contributed in large measure to the small size and high efficiency of this machine. Hardly longer than a dime and weighing but 1/15th of an ounce, they give the long-life, trouble-free performance such a product must have.

* * * *

MICRO even gives self-control to textile thread. When the bobbin needs refilling on the loom of a well-known manufacturer of textile machinery, a MICRO switch signals the operator in time to avoid thread breakage. This gives a reliability and continuity to loom operation never possible to obtain by mechanical means. The result—better production—smoother operation and happier customers.

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stead of continuous use of a sensing antenna in conjunction with the loops. This continuous antenna is a weak link in conventional LF sets, Gavco says, as it constantly introduces static into the system when static conditions prevail. By hooking in the sensing antenna only briefly, static is introduced only briefly. And even this momentary disturbance tends to be canceled out in the dual circuitry, according to the company.

The sense antenna determines whether the range station is ahead of or behind the plane. It does this by introducing a temporary imbalance in the normally equal voltage in the twin circuits (when set is homed) which actuates a relay. This switches the radio compass to the reciprocal of the bearing when the plane is flying "from" the station.

The temporary voltage imbalance, signifying a change in the "to-from" status, is accomplished through the RF phase and reverse polarity arrangement of the loops in an interplay with the sensing antenna. Radio frequency of one loop is always opposite in phase to the other, one loop supplying plus voltage, the other minus, alternately. Further, the loops change polarity when their positions change in relation to the range station.

The sense antenna provides a constant reference phase for the loops. It is the movement of the loop and change in its position relative to the range station that alters the relationship in phase and polarity between it and the sense antenna. Thus, the sense antenna, to supply "to" or "from" information, upsets the circuit balance, adding voltage to one loop and subtracting from the other, and vice versa, depending on their phase and polarity.

The twin-loop circuits, always opposite in RF phase, tie into a single balancing circuit, and if voltages are equal they cancel each other at this point, creating a balanced condition to indicate loops are homed.

This also is true of static to which both loops are equally exposed. As static voltage is equal in both loop circuits it tends to cancel out at the balance circuit. This feature is exclusive with the Gavco set, the company claims.

▶ **Set Components**—In addition to the antenna, the prototype equipment, subject to miniaturization, consists of a dual ADF receiver and a common oscillator in one housing, a control box incorporating all automatic controls, the radio compass, crosspointer indicator and pilot's switch panel.

The switch panel permits range station selection, manual left-right operation of the loops, a manual checkout of sense and balance circuits, and includes sense antenna and power switches.

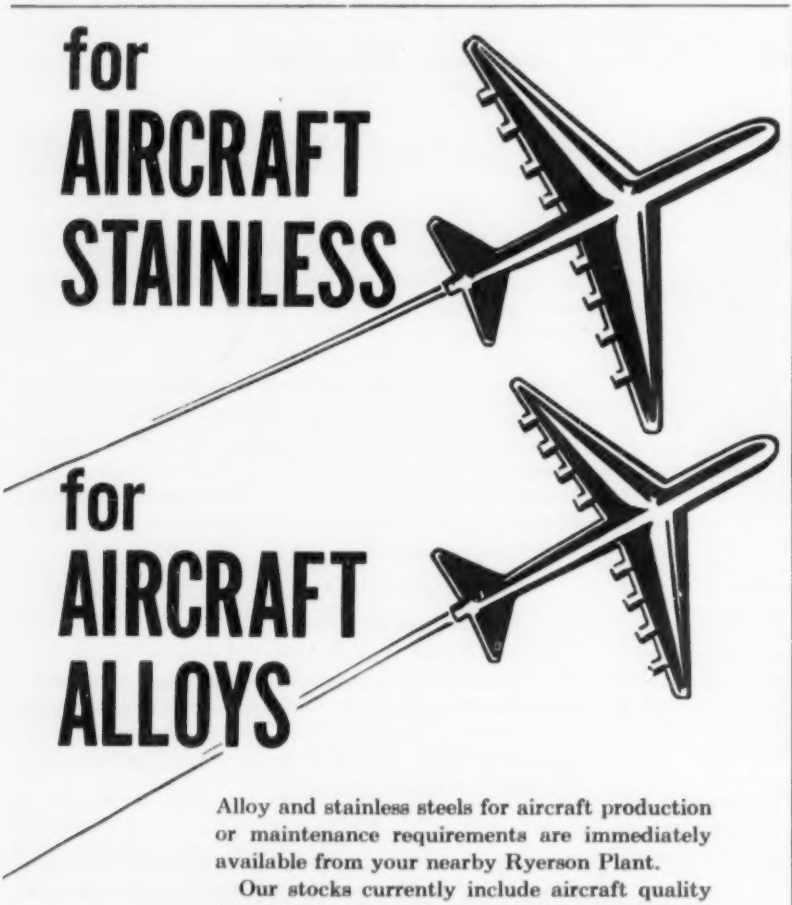
The crosspointer indicator, in addition to providing a continual check on accuracy of the radio compass, provides the sensing indication required when operating the loops manually. It also indicates when plane is flying through the cone of silence and indicates night effects on radio signals.

▶ **Twin Loop Not New**—The twin-loop antenna is not a recent development. What is new is its application in a direction finder that is completely automatic, Gavco says.

The basic unit was developed in 1933 by E. J. Simon Radio Navigational Instrument Co., and was first flight tested in 1934 as part of a manually operated system. Later, it could be found in regular service on a Martin flying boat used by Pan American in trans-Atlantic service, and on DC-2s. Around 1938, it was carried on a craft which flew around the world.

An advantage cited for the set is that the principles it employs have been tried and proven in service.

In a statement for AVIATION WEEK, Dr. Lee De Forest, inventor of the triode vacuum tube, and one of the world's leaders in radio development, said he believes "the twin-loop, double-channel principle of direction find-



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ing . . . is still the most dependable system on LF."

Harry Ashe, veteran pilot and aviation writer, now chief pilot for the Max C. Fleischmann Foundation, Reno, Nev., gives this account of his experiences with the early manual twin-loop direction finder: "When all other (LF) radio equipment failed to function because of severe precipitation static and icing, your system (Gavco's) continued to operate reliably."

Across the board emphasis on VHF after World War II, and slowness in adapting the twin-loop to an automatic system caused the two-channel system to be temporarily eclipsed, Gavco officials say.

An automatic system finally was developed (by Airlectron, Inc., headed by J. R. Schoenbaum, in collaboration with E. J. Simon, inventor of the original set). But this set was lost when American Airlines' research plane, the Alpha, crashed into Flushing Bay near La-Guardia Field in 1947. Further work was virtually halted until recently, when Gavco purchased patent rights to the unit and took on Schoenbaum as chief engineer to continue direction of the program.

Gavco Corp.'s address is 540 E. 80th St., New York 21, N. Y.

Runway Picture

A hand-adjustable flight card that graphically shows the private pilot his position in relation to the runway in a presentation similar to that provided by costly navigation instruments in larger planes is being marketed by Flight Aids, Waltham, Mass.

Unlike intricate navigational aids in transports, with this one-dollar device the pilot must supply the heading information. The card then gives him an actual picture of his position.

Features of the circular Tele-Runway card are a black strip representing the runway, a 360-degree compass rose, and listings showing proper quadrantal flight altitudes in accordance with CAR 60, the revised VFR flight plan sequence and control tower light-gun signals.

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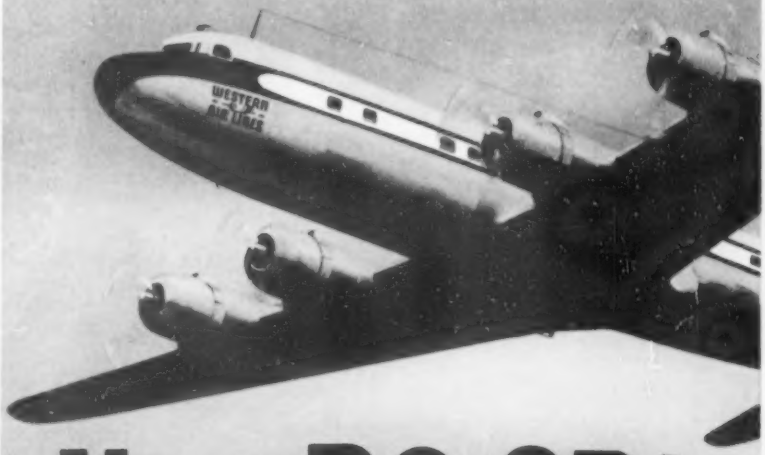

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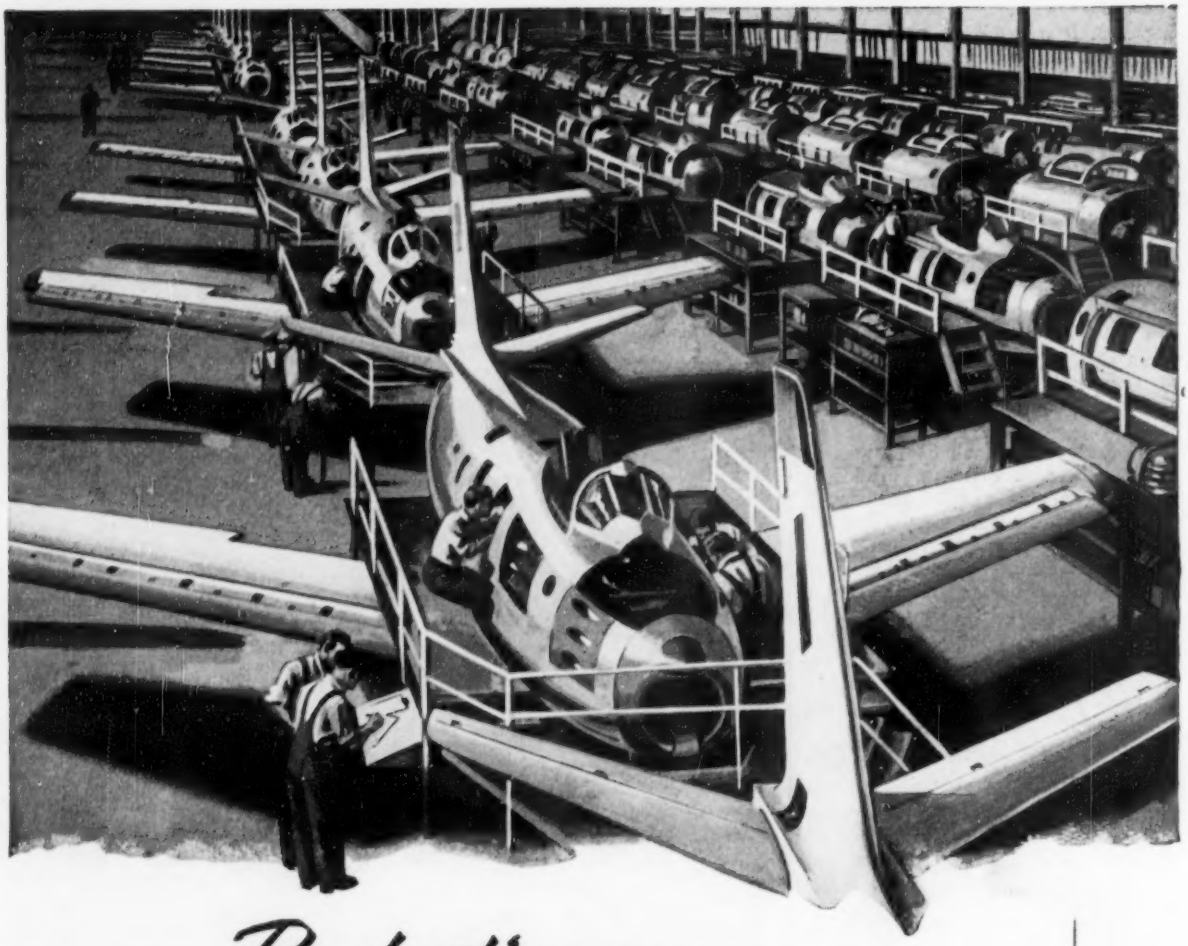

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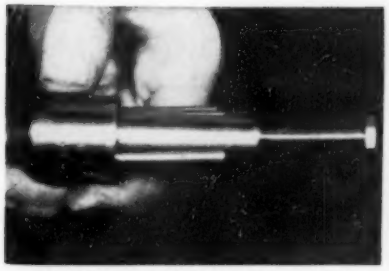
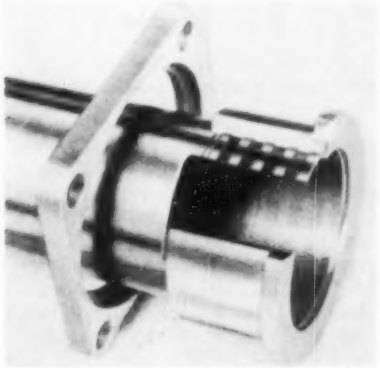


MANDREL expands tube into grooves of . . .



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Leak-Tight Fitting

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Just a few steps gives a secure fit capable of withstanding temperature and vibration extremes encountered in fluid and gas systems, and those using corrosive agents in planes and missiles, the company says. The fitting is claimed able to resist any pressure the tubing itself can take.

Non-brazing aluminum alloys such as 52SO tubing can be joined to 17ST fittings easily by this means, according to the firm. Or the 24ST fitting may be used with 52SO or 61ST tubing. Fittings and tubing of non-weldable grades of stainless steel may be used.

Various methods of connection are provided, including AN 756 swivel flanges for bolting, threaded swivel nuts for AND 10056 joints, a variation of this nut which slips back out of the way to ease installation, and plain fittings shouldered to accommodate vee-clamps.

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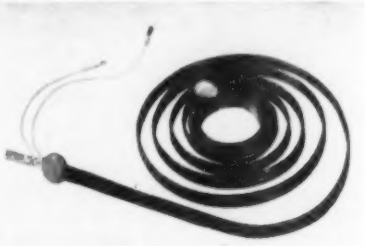

airlines use it to keep water in pipes leading to washrooms from freezing.—Air Associates, Inc., Teterboro Air Terminal, Teterboro, N. J.

German Schenck balancing machine will detect displacements of only .00004 in. from center of gravity. It shows amount and location of dynamic and static unbalance in rotating parts (weighing from a few ounces to over 100 tons) on wattmeter with electrical measuring system that uses no electronic tubes or oscillographs.—Cosa Corp., 405 Lexington Ave., New York, N. Y.

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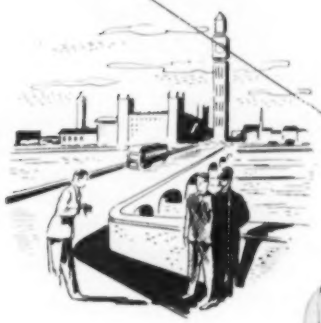

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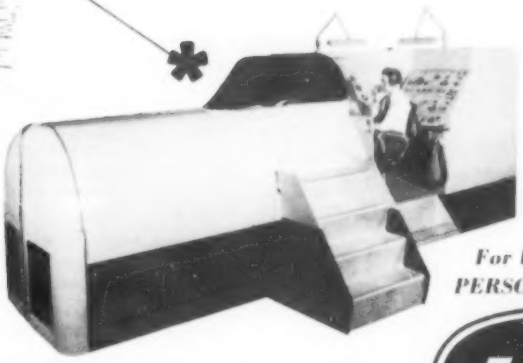

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WINDSHIELD CLEANER
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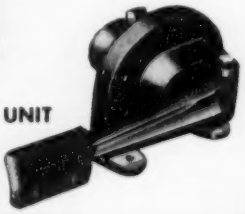
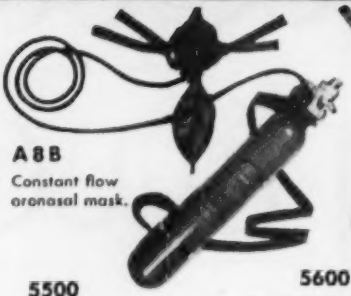
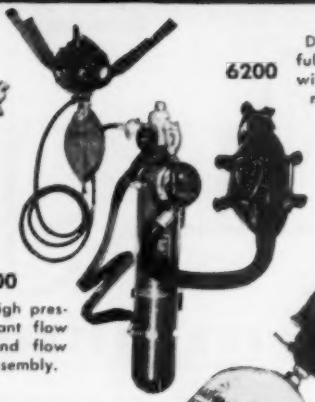


B711 BRAKE UNIT
Master Cylinder with Heel Pedal.



A8B
Constant flow oronasal mask.

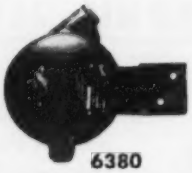


6200 Demand flow full-face mask, with or without microphone.

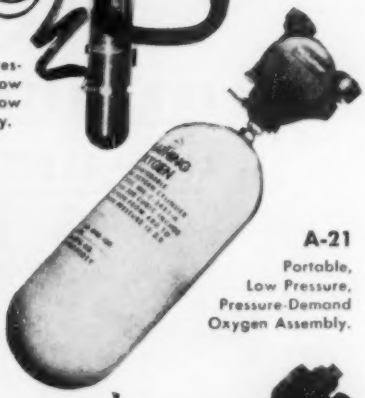
5500
Portable high pressure constant flow oxygen assembly.

5600
Portable high pressure constant flow and demand flow oxygen assembly.

8550
Oxygen Regulator for Scott 8500 Fixed Oxygen Systems.

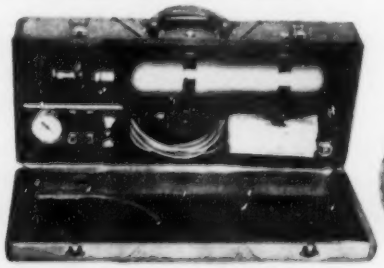


6380
Demand Flow Regulators for fixed installations.



A-21
Portable, Low Pressure, Pressure-Demand Oxygen Assembly.

8540 Oxygen Flow Indicator



AVIOX Portable Oxygen System for four persons, complete in a luggage case.

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A15
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Automatic, Steerable, and Full-Swivel Tail Wheel Assembly with 6 inch solid tire.

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CAB May Force Alaskan Route Mergers

- **Drastic program would streamline system.**
- **New action aims at lower subsidies, better service.**

By Lee Moore

Civil Aeronautics Board has proposed a drastic program to clean up the Alaskan air route system by forced mergers and route suspensions. In two "orders of investigation," CAB proposes merger of nine intra-Alaska carriers and purchase by Western Air Lines of two U.S.-Alaska lines—Pacific Northern and Alaska Airlines.

Highlights of CAB's new Alaska program:

• **Slash the $7-million subsidy** paid annually to Alaskan carriers but, at the same time, improve service.

• **Free "pilot-owner,"** non-subsidized bush fliers, from route prohibitions that have made the back-country Alaskans severe critics of CAB.

• **Suspend competitive routes** of certificated intra-Alaska carriers, except on a few routes where the Board decides business potential can support more than one airline.

• **Suspend unlimited rights** previously granted some certificated Alaskan carriers to fly anywhere in certain geographical areas.

• **Merge Western** with Pacific Northern and/or Alaska Airlines. CAB hopes this would effect an immediate cut in the U. S.-Alaska subsidy paid to PNA and Alaska from $2 million a year to less than $1.3 million (Pan American World Airways' estimated subsidy).

• **Merge 11 intra-Alaska** carriers into four largely non-competitive airlines.

• **Sever intra-territory routes** of Pacific Northern and Alaska from their trunk flights to the U.S.

▶ **CAB Power**—The Board has three major weapons to force airline cooperation in its Alaska program:

• **Certificates expire** this year for most carriers in the territory.

• **Subsidy grants** are set by CAB.

• **Route suspension power** of the Board has been upheld by federal courts.

Because route suspensions are proposed as definite issues in this investigation, CAB can order suspensions immediately after conclusion of the case.

▶ **Carrier Positions**—Here is the status of Alaskan carriers CAB has included in the merger and route suspension proposals:

CARRIER ROUTES involved in CAB investigation of Alaskan air transport system.

• **Pacific Northern.** States-Alaska certificate expires Dec. 13; a CAB order gives PNA $818,000 subsidy for operating the route. The airline's intra-Alaska route certificate does not expire soon, but Pacific Northern has been abandoning it gradually to concentrate on the U.S.-Alaska route. Subsidy on the intra-Alaska segments totals $416,000 a year, according to a CAB estimate.

• **Alaska Airlines.** States-Alaska route also expires this Dec. 13; present subsidy is approximately $1 million a year. The company's most important intra-Alaska mail route certificate expires July 1. The carrier is subsidized at $496,000 annually.

• **Reeve Aleutian Airways.** Certificate expired last month. CAB subsidy is $28,000 annually.

• **Northern Consolidated Airlines.** Main route expires July 1. NCA is subsidized at an estimated $1 million a year.

• **Wien Alaska Airlines.** Certificate expires in 1956. Its route system is described by CAB planners as a logical one on which to build a unified northern Alaska system, incorporating routes of such other carriers as Byers Airways. Present Wien subsidy is $651,000 per annum.

• **Byers Airways.** Certificate expires this year; subsidy was increased recently by CAB from $30,000 to $46,000.

• **Cordova Air Service.** Certificate has some mail authorizations (subsidy) expiring next year. Latest CAB subsidy estimate is $317,000 annually.

• **Alaska Coastal Airlines** is one of two Southern Alaska airlines that CAB planners tentatively propose to leave alone. Annual subsidy: $279,000.

• **Ellis Airlines** is the other southern Alaska carrier slated to continue much as it is now. Ellis and Coastal have exclusive routes on the main run between Juneau and Ketchican and make use of each other's facilities at these terminals.

• **Bristol Bay Airlines** and **Muz Air Service** are included in the CAB investigation, but they have permanent non-mail pay route certificates. CAB has no subsidy control over the two carriers but hopes the threat of merger by their competitors will influence Bristol Bay

and Muz to cooperate in proposals arising from the investigation.

• **Christensen Air Service,** certificated non-mail carrier, recently suspended service.

• **Alaska Island Airlines** has merged with Alaska Coastal.

► **U.S.-Alaska Route**—The intra-Alaska merger investigation is a separate case from the Western-PNA-Alaska Airlines merger proposal, which CAB is consolidating in the "States-Alaska route renewal case."

Northwest Airlines U.S.-Alaska certificate comes up for renewal Dec. 16 and will be included with Pacific Northern and Alaska Airlines in the case.

CAB chief examiner Francis Brown is handling both investigations.

United Air Lines is expected to intervene in the merger, proposing itself as an alternative to Western. Northwest also may propose such merger.

CAB staff is expected to favor merger of PNA and Alaska with a larger airline on these grounds:

• **Small carriers.** Pacific Northern and Alaska have little equipment, complicating maintenance and service. This causes high subsidy for the service rendered, but CAB officials say the records of PNA and Alaska are improving.

• **Turn-around route** of their present Alaska-Seattle-Portland setup does not tap the major western markets. This is an argument for merging them with either Western or United.

• **Competition** of Western or United with Pan American and Northwest would be greater than the present setup.

• **Western route** system is one of the last regional trunks. CAB has favored expanding service of the small regionals through merger and interchange.

PAA '52 Revenues Top $205 Million

Pan American World Airways reports all-time high gross revenues of $205,243,000 for 1952, with net earnings $6,673,000 after federal income taxes.

This compares with operating revenues of $188,560,000 and net income of $6,546,000 in the previous year.

New highs also were achieved last year in revenue passenger-miles, which reached 1,807,000,000, and cargo ton-miles, which hit 51,617,000. The number of passengers carried in 1952 increased 11% over the previous year to 1,426,000. Average passenger trip was 1,267 mi. In 1952 the carrier completed 40,000 Atlantic crossings, 24,000 trans-Pacific flights and 1,500 on around-the-world service. The carrier says 28% of all overseas travel to and from the continental U.S., including ship passengers, is carried by its own planes.

Expenditures for new equipment last year totaled $29.8 million.

Viscount Service

- **BEA starts turboprops on scheduled flights.**
- **New transports cut route time by 20 min. to 1 hr.**

(McGraw-Hill World News)

London—Vickers Viscount 701s are cutting 20 min. to one hour from flight time on British European Airways routes, the first air service to use turboprop transports.

Inaugurated simultaneously with the introduction of new tourist fares on virtually 95% of Europe's air routes, the 40- and 47-seat Viscounts are flying BEA's London-Rome-Athens-Istanbul service five days a week. Twice-weekly turboprop flights to Cyprus and daily services in Zurich and Geneva are scheduled to start soon. By July, daily Viscount service will start to Copenhagen and Stockholm.

BEA is flying five Viscounts, has 21 more on order. Deliveries are expected at a rate of about two every three months.

Powered by four Rolls-Royce RDa3 Dart turboprops, the Viscounts cruise slightly faster than 300 mph., can maintain a top speed of nearly 340 mph. Running time on BEA's services will be cut from 20 min. on shorter runs to an hour on the London-Stockholm run.

► **London-Rome**—To find out the kind of service a passenger can expect in turboprop aircraft, AVIATION WEEK flew on a proving flight to Rome. The 929-mi. flight was made in 3 hr. 36 min., compared to scheduled time of 4 hr. 10 min. for conventional piston types. The return flight was completed in 10 min. less time. Scheduled Viscount flights to Rome will be quoted at 3 hr. 40 min.

There is practically no vibration while taxiing in a turboprop transport. No reciprocating parts are in the Dart engines, eliminating noisy warmups and making the takeoff procedure a much quieter and more comfortable process.

► **Soundproof Flight**—In the air, noise over the wing and aft in the Viscount's fuselage is markedly lower than any piston-powered types now in general use—but not so low as on the pure jet Comet. Abreast the engines, there is a marked increase in noise, approximating normal Constellation or DC-6 levels. Even here, absence of the pulsating throb of a piston engine is noticeable. The four Dart engines aren't quite synchronized, but it takes a sensitive ear to pick out the beats.

The climb to cruising altitude, usually 21,000 ft., takes about half an hour.

On the London-to-Rome flight, a mildly unpleasant whine was noticeable when pressurization was turned on. On the return trip in a different aircraft with new sound-proofing, this noise was damped and the general noise level was reduced even further.

Cruising at altitude is smooth but not up to the dramatic stillness of a Comet cruising at its altitude of 40,000 ft. Lack of vibration in the Viscount is fairly uniform from the cockpit to the rear.

► **Conventional Comfort**—Inside the fuselage on the 40-seat 701 the passenger enjoys conventional comfort increased by a better-than-average view from large oval windows. But in the 47-seat tourist version, the cabin is quite crowded:

• **Seats** are uncomfortably narrow.

• **Center aisle** is cut to one-way traffic.

One BEA official says it is too bad the spacious fuselage of British European's Elizabethan (de Havilland Ambassador) transport couldn't be adapted to the Viscount.

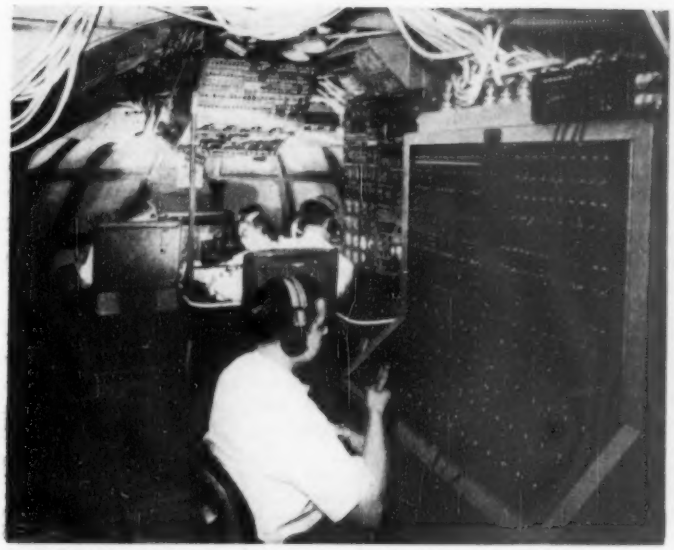
► **Escape Hatch**—About 50 mi. from Rome the pilot begins his letdown. As on the Comet (which starts its letdown 200 mi. out), the two inboard engines are idled, introducing a mild turbine whine into the cabin. During the decrease in altitude, passengers in window seats are liable to get a slight dousing from condensation forming around the windows.

Each Viscount window is designed as an escape hatch, affording the Viscount more access than any other aircraft now in service. Two oval panes are separated by a rubber gasket: a release mechanism and a large handle allow the windows to be pulled into the cabin in emergencies.

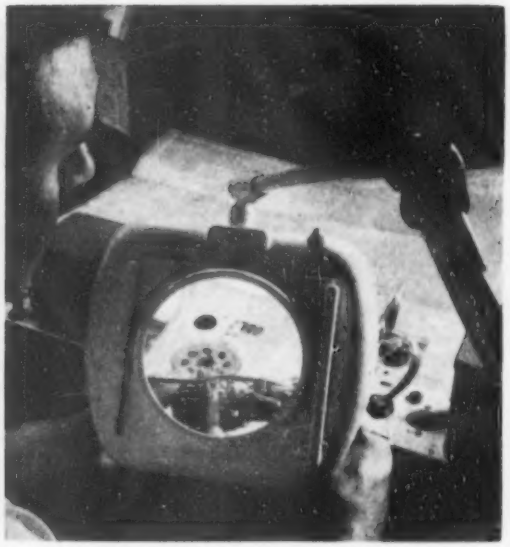
► **Selling Points**—It takes only nine minutes from the start of letdown to the approach of the airfield. With 52,000 lb. maximum landing weight, the Viscount needs 880 yd. of runway. Coming into Rome's Ciampino Airport, the aircraft took only slightly more than half the runway.

Aside from economics, advent of turboprop flight isn't likely to diminish the desirability of civil jet transports for passenger comfort. But reduction of vibration by the Viscount is a big selling point in that it lessens travel fatigue.

Economic attractions of the turboprop on runs of 900 mi. and less are better than present-day jet operations. Total fuel consumed on the flight to Rome (929 mi.) was 1,037 gal.; 47 passengers were carried. On a similar Comet flight to Rome carrying 36 passengers, more than 1,500 gal. were used.

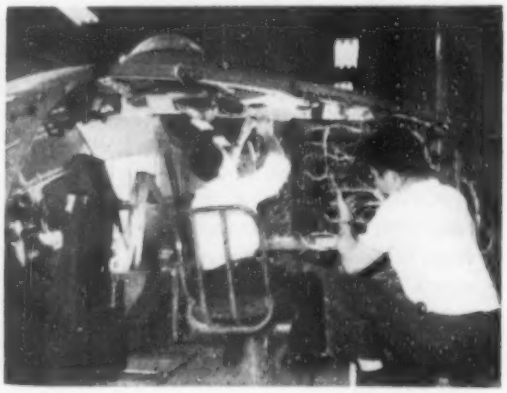


C-97 SIMULATOR (instructor foreground) duplicates actual plane's cockpit.



MAGNIFYING GLASS is used for precision work on relay.

FLIGHT DUPLICATORS on assembly line at C-W Electronics Division.



INTRICATE WIRING being fitted on AF B-36 simulator.

Three Airlines Buy Transport Simulators

Growing demand for electronic flight simulators to improve aircrew training and cut costs soon will bring a new batch of multi-million-dollar orders from airlines, Air Force and Navy. At least two major airlines are negotiating with the Curtiss-Wright Corp., and Pentagon sources indicate there will be an increase in the already strong emphasis on military simulator training.

In addition to numerous tactical aircraft simulators, orders for transport types are in a strong uptrend. Types delivered or on order, and buyers:

- **Douglas DC-6B,** United Air Lines and Air Force.
- **Boeing 377 and C-97,** Pan American World Airways, Civil Aeronautics Administration, Air Force and British Overseas Airways Corp.
- **De Havilland Jet Comet,** BOAC.
- **Convair-Liner,** United and Air Force.
- **Douglas C-124,** slated for Air Force delivery this month.

Eastern Air Lines and Trans World Airlines, Constellation and Martin operators, recently ordered the simpler Curtiss-Wright "flight duplicators," navigation trainers costing about $35,000 each (compared with around $750,000 for a flight simulator). TWA and Eastern presumably have refrained from buying simulators because there have been no military orders to grease the way to quicker, lower-cost delivery to an airline. The duplicator is a modern version of the World War II "Link Trainer" of Link Aviation.

Other airlines ordering Wright duplicators: Pan American, Air France and TWA. Air Force also has purchased duplicators.

"Radio aid" attachments further diversify uses of both simulators and general trainers. UAL, Eastern, PAA, TWA, American Airlines, Air France and the Air Force have bought these.

▶**CAA Promotes Simulator**—To encourage purchases, CAA recently told the airlines they can use simulator time in lieu of about half the required in-flight pilot check on six-month refresher proficiency tests.

CAA further conceded that DC-6B flight trainers could be so used for DC-6s and Super Constellations or Constellations, or vice versa. Military training psychologists and simulator manufacturers deplore any compromise with true simulation.

The Doolittle Airport Commission and new CAA administrator Fred B. Lee have called flight simulators one of the most important developments for air safety improvement. In the simulator, an airline can train crews on problems and emergencies too difficult or dangerous for inflight practice:

- **Powerplant failure on takeoff.**
- **Engine fire.**
- **Propeller reversal.**

Lee told AVIATION WEEK the simu-

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lator thus is especially valuable for training on takeoff and landing. He noted that landings and takeoffs account for 95% of all accidents, according to research of Ben Howard, a leading test pilot and design consultant.

▶ **High Cost**—Airline orders for simulators are slow in coming because of the high initial cost—nearly as much as the price of aircraft it imitates. But proponents argue the long-term cost is less than inflight training because of:

- **Accident prevention.**
- **Lower cost operation,** estimated at $65-$70 an hour including depreciation, compared with $200 and more aircraft time.
- **Revenue saving,** by freeing planes previously devoted to training.

▶ **ATA Study**—Airlines long have been considering how to replace World War II Link navigation trainers as they wear out. After the Doolittle Commission urged carriers to buy simulators a year ago, interest stepped up in the training devices. Air Transport Assn.'s chief pilots committee set up a five-man group last July to study requirements and recommend specifications for an ideal economical training device.

The ATA committee came up with specs for a compromise device more elaborate than current navigation trainers but without the actual flight characteristics of a true simulator. The group proposed a two-seat, twin-engine navigation trainer with complete engine, surface control and radio instrumentation. Cost estimates from manufacturers range from $100,000 to $300,000 each, depending on production specifications and quantity of orders.

Airlines still are studying the ATA committee's proposed specifications.

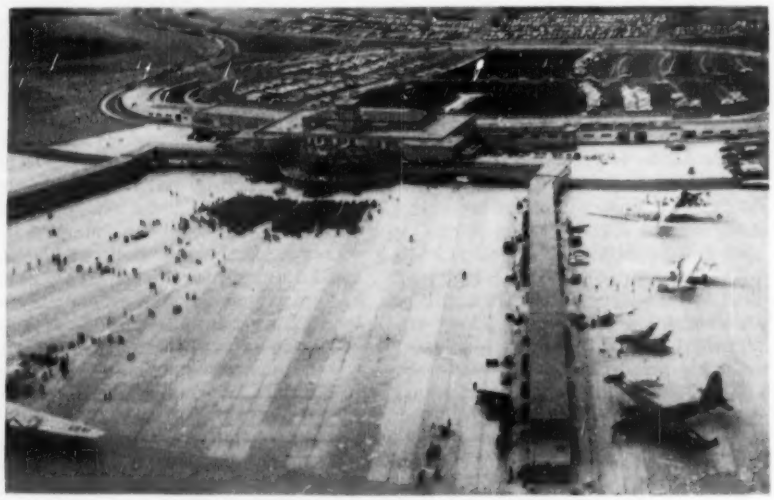
Dissenting Opinion

Civil Aeronautics Board members Joseph Adams and Josh Lee last week were drafting a dissenting opinion strongly critical of a majority decision to compromise the general fares investigation (Aviation Week Apr. 27, p. 91).

Harmar Denny, who held the balance, changed from a preliminary vote for continuing full-scale investigation to a final vote for dismissal of the hearings and argument and proceeding with a modified survey (agreeing with Oswald Ryan and Chan Gurney).

The Lee-Adams dissent probably will imply that the majority decision makes the Board a "captive" of the industry it is supposed to regulate. It probably will say that if the Board does not stand up to the airlines in an investigation of fares and earnings there is little chance of the present majority ever changing rates without airline consent.

Ryan and Gurney swung Denny to their side on the contention that a staff survey without argument will get the same facts and specific action recommendation faster and cheaper.



AMON CARTER FIELD DEDICATED

Helicopter view of dedication ceremonies held recently at Amon Carter Field (Ft. Worth, Tex., International Airport) shows the administration building and finger-like plane loading platforms. Behind the terminal building is a heliport. Ceremonies included displays of commercial and military aircraft. A Lockheed P2V Neptune and Chance Vought F7U Cutlass are in the foreground. A giant Convair B-36 also was present. The new 1,780-acre field, opened for service Apr. 26.

SHORTLINES

▶ **Air Transport Assn.** general counsel S. G. Tipton asked House Committee on Public Works to exclude aviation tire, gas and oil taxes from proposed trust fund for highway purposes, and to certify them instead to the Treasury as an offset to federal airways expenditures.

▶ **Airwork, Ltd.,** British all-cargo line has rights to operate until Mar. 31, 1960, from London to Nicsia, Tripoli, Kukuk, Baghdad, Basra, Kuwait, Dharan—with technical stops at Nice, Malta, Rome and Athens.

▶ **Allegheny Airlines** passenger revenues in March gained 30% to $123,000. First-quarter revenues: $340,000.

▶ **British European Airways** reports fiscal 1952/53 traffic to Feb. 28 gained 23% from the year before, "despite the foggiest winter in the history of civil aviation."

▶ **Australian National Airways** denies persistent rumors it considers quitting the airline business. Australian sources report ANA's agreement with the government-owned Trans-Australia Airlines is working smoothly.

▶ **Central Airlines** has asked CAB for a new route Little Rock-Tulsa.

▶ **Civil Aeronautics Administration** has cut cost of the Airman's Guide from $6 to $4.75, effective immediately. . . . CAA has established a single standard for aircraft taxiing signs at large and small airports; it is in Technical Standard Order N-23.

▶ **Colonial Airlines** has started daily Constellation service New York-Bermuda using Eastern planes.

▶ **Eastern Air Lines** reportedly has ordered six more Lockheed 1049Cs, making 22 on order—in addition to the 14 regular 1049s already operating.

▶ **LAV,** Venezuelan airline, plans direct Constellation flights to Madrid, Lisbon and Rome.

▶ **National Airlines** reports passenger traffic Jan. 1-Apr. 15 this year gained 41% from a year ago, and Piggy Bank budget vacation tours are "more than double last year's sales at this time."

▶ **Northwest Airlines** last week started flights "every hour on the hour" between Chicago and Twin Cities.

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SO THEY TELL US

From Korea

It hasn't appeared in the press, but the number of Russian air violations of Japanese borders has dropped almost to zero since USAF moved F-86s to northern Japan and announced it would shoot down intruders. . . . **Air officers** in Korea sometimes wonder why, in three years of war in that country, no MiG pilot has tried to fly his ship south to U. S. bases in the manner of the Polish pilot who recently landed in Denmark. Best guess: mixed flights, with Russ pilots keeping a close eye on satellite pilot. . . . **Col. Roy Baker,** Korean ace who came home recently, credits many of his victories to Air Force's automatic radar gunsight, disagrees with critics who say weight penalty outweighs value of sight. . . . Small size of the Korean war is emphasized by the fact that combat losses often are lower than **operations losses** of stateside units. In fact, one B-26 outfit in Korea in a recent month lost more men and aircraft to accidents than it did to enemy action. . . . Commanding officer of one of the outstanding Marine ground units in Korea says the combination of the **armored vest and the helicopter** is 100% morale booster in his outfit. . . . **Sabre pilots** sometimes carry binoculars to aid in spotting and identifying enemy aircraft under difficult high-altitude visibility conditions and also to keep an eye on MiG bases in the Antung complex north of the Yalu. Air Force now is considering making such binoculars standard equipment for fighter pilots. . . . Reminiscent of the ammunition shortage publicity is the popular Korean saying: "Nothing's too good for our troops . . . and that's just what we're getting." . . . **Maj. Gen. Samuel E. Anderson,** CG of the 8th AF, with headquarters at Carswell AFB, is replacing Lt. Gen. Glenn O. Barcus as head of the 5th AF in Korea. This assignment of a SAC general to Seoul headquarters surprises some observers, because no SAC aircraft are based in Korea. (B-29s on Korean missions fly from bases in Japan and Okinawa and are under Far East Bomber Command, not 5th AF.) Some wonder if SAC replacement for Barcus, whose 5th AF has been a leader in the fight for the lightweight day superiority fighter, can be considered a political victory for SAC.

DH Views on Jets

Several executives from **British de Havilland** were in the U. S. the other day and pointed out: (1) One of their big targets for jet operation is use of bunker oil as fuel; although some gossip has mentioned diesel oil as a prospect, they note that it goes solid at 5 deg. C. and heating would take power off the engines. (2) They reacted to skepticism in the U. S. on possible Comet servicing difficulties by saying that 3,000 DH planes already operate outside U. K., and that 60 DH engineers are constantly on the road throughout the world with thorough understanding of after-sale service. (3) Asked about **Mark 4 Comet,** they said, "In a year's time we'll be giving it serious thought. Right now some of the backroom boys are thinking of it as the 1960 model. Actual engineering does not exist." (4) BOAC was given a fixed price on its Comet for **Ghost** engines performing 450 hr. between overhauls, another price when the period reaches 600. By mid-year it is hoped 750 hr. can be attained. Engines are functioning "very well" now at 450. (5) DH people so far see no future for **aerial refueling** with Comets. They would need a jet tanker, and they worry about passenger reaction. (6) They are pessimistic about any real reduction in jet engine noise in the near future, although less rpm. is a possibility for some relief. (7) They bolstered industry's position here against any jet aircraft project administered by a committee that includes government members. "The **specification airplane** has never worked; you need the close contact between creator and user." (8) DH officials concede the British government financed total development of the Ghost engine but still maintain that Comet development was not subsidized. "The government bought, at a commercial price, the first two Comets after DH guaranteed speed, payload, range and delivery date. The government paid the same price for the first two Comets as BOAC paid for one. We had technical liberty at all times." (9) The first four **Herons** (double Dove) have been sold in New Zealand, Brazil, Norway and Australia. U. S. certification is expected to be "automatic."

AVIATION CALENDAR

May 6-7—Second annual Skylady Derby, sponsored by Women's National Aeronautical Assn., sanctioned by NAA and conducted under FAI rules. From Fort Smith, Ark., to Memphis, St. Louis, Kansas City and return to Fort Smith. WNAA's twenty-fourth annual convention will follow at Fort Smith.

May 8-9—First Northwest Quality Control conference, sponsored by Seattle section, American Society for Quality Control, University of Washington, Seattle.

May 8-10—Oklahoma City Air Fair, Will Rogers Field, Oklahoma City, Okla.

May 11-13—National Conference on Airborne Electronics, Dayton Biltmore Hotel, Dayton, Ohio.

May 14-16—American Helicopter Society Forum, Mayflower Hotel, Washington, D. C.

May 15—Air Youth Day, Los Angeles International Airport.

May 16—Armed Forces Day, open house programs at local USAF, Navy, Army, Marine and Coast Guard installations.

May 16-17—Virginia Aviation Jubilee air show, Byrd Field, Richmond.

May 17—Third annual Spring Roundup and Open House, San Fernando Valley Airport, Los Angeles.

May 18-22—Fifth National Materials Handling Exposition, Convention Hall, Philadelphia.

May 18-22—Aviation Seminar, National Fire Protection Assn. annual meeting, Palmer House, Chicago.

May 18-22—Twelfth annual conference Society of Aeronautical Weight Engineers, Olympia Hotel, Seattle.

May 19-22—Annual convention Aivation Writers Assn., Dallas-Ft. Worth, Tex.

May 20-22—Spring meeting Society for Experimental Stress Analysis, Hotel Schroeder, Milwaukee.

May 31—Fifth annual Wright Memorial Glider Meet, South Dayton (Ohio) Airport.

June 5-July 5—20th International Aviation Display, sponsored by the Union Syndicale des Industries Aeronautiques, Bourget Airport, Paris.

June 9-11—Second International Aviation Trade Show, Hotel Statler, New York.

June 11-13—Fifth annual All-Women International Air Race, Weeland, Ont., to New Smyrna Beach, Fla., sponsored by Ninety-Nines, Inc.

June 16—Seventh session of the assembly of the International Civil Aviation Organization, Brighton, England. Session is expected to last three to four weeks.

June 16-19—Spring technical meeting of the American Welding Society, Shamrock Hotel, Houston.

July 9-12—Sixth International Aviation Exposition, Wayne County Airport, Detroit.

July 15-16—IAS Annual Summer Meeting, Honors Dinner, IAS Building, Los Angeles, Calif.

Sept. 5-7—National Aircraft Show and 50th anniversary of powered flight, Dayton (Ohio) Municipal Airport.

Sept. 7-13—1953 SBAC Coronation Year Flying Display, Farnborough, Hampshire, England.

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EDITORIAL

Startling Intelligence Innovation

Gen. Mark Clark's offer of $100,000 and refuge to the first Red pilot who will deliver a MiG-15 fighter to the Americans is a startling innovation in psychological warfare, propaganda, and intelligence methods. It is to be hoped it marks the beginning of a more realistic policy.

The $100,000 price seems high. The difference between $5,000 and $100,000, must hardly be comprehensible to a Chinese who may never have seen as much as five dollars, or its equivalent, at any time.

Nevertheless, if we get a late-model MiG, intact, it may be worth the price. If we don't, we will have the satisfaction of suspecting we have tossed another source of distrust into the Red flying legions who will be eyeing their fellows as closely as the U.N. flyers they are sent out to fight. What can we lose by trying?

The Clark offer, as dramatic a break as it is with routine and unimaginative procedures, is not original. The United Press reports an Allied pilot suggested offering a reward a year ago, and a flurry of newspaper stories recently credited a group of Maryland citizens with financing the escape of a Polish MiG pilot to Denmark in March. Danish authorities, acutely embarrassed to find themselves in the middle of a delicate East-West incident, obviously denied the Americans' story. This European MiG, described in AVIATION WEEK as an older version than the jets now fighting in Korea, was later shipped back East after a thorough inspection by Western officers. We still don't have a flyable MiG.

There also was an opportunity three years ago to make a serious effort to win a MiG over to this side of the Iron Curtain, as reported elsewhere in this issue. At that time an Air Force general in Europe rejected an offer relayed from a Czech pilot to deliver a MiG-15 for $10,000 and political asylum. This was in 1950, before the then-sensational fighter had even appeared in the Far East. We still don't have a flyable MiG.

But even if the Clark offer is not an original idea, it is almost breath-taking to those who are accustomed to the traditional methods of compiling military intelligence material.

According to all of those we respect and consult on such matters, our intelligence people still know pitifully little about Russian aviation. This opinion was reinforced the other day by the scant reports of air technical intelligence officers in a closed meeting in Dayton between the Air Materiel Command and top public relations executives of the aircraft industry. Several industry men left this meeting astonished at the meager data we have on the Russians.

Why is this? There are many reasons, most of them tied to the problems inherent in government organization, methods and limitations. Government always tends to be more inefficient than the better examples of business or private enterprise. Military intelligence not only contends with the usual problems of civilian bureaucracy, but it has the added hurdles of the military, as well.

So we find military intelligence continually fighting "the system." This is complicated, conservative, slow-moving, subject always to agency politics and political considerations in winning funds. Leadership changes frequently, and is more often unenlightened and inexperienced than not. Pay of second and third civilian echelons is lower than it should be and does not attract as many capable men as the importance of the jobs require. For the average uniformed personnel, it is often just another assignment, demanding little in experience and ability.

So we have the great United States of America depending for vital information—some of it of life-or-death import—on military intelligence services that are woefully inadequate to seek, gather, edit, interpret, evaluate and communicate facts to the leaders who have the power and responsibility to take prompt overt action when necessary.

We doubt if bureaucratic personnel and methods will ever be adequate to do the job alone. One system that works is the newspaper city room or news wire service plan, headed by smart editors with a "nose for news" rather than a penchant for documents, theses, undigested data merely copied from periodicals, or reams of unimportant or already-known data. Why not staffs of well-paid, keen reporters, trained engineers and capable analysts who know what they want, do plenty of traveling and interviewing, and know what they have when they get it?

It is high time we streamline military intelligence; catch up with the press and get far ahead of it, so the sheafs of clippings are unnecessary; stop writing a lot of the voluminous reports—nobody reads them now, nor does anything about their contents if they do—the stuff is too old; take action on those unsatisfactory reports on Korean equipment; somehow, find a way to compile the material the country needs.

Giving Fun a Bad Name

We have admired the ingenuity of one of the trans-Atlantic steamship lines in trying to "sell" the slow pace of their lumbering giants. "Half the fun is getting there," the ads say.

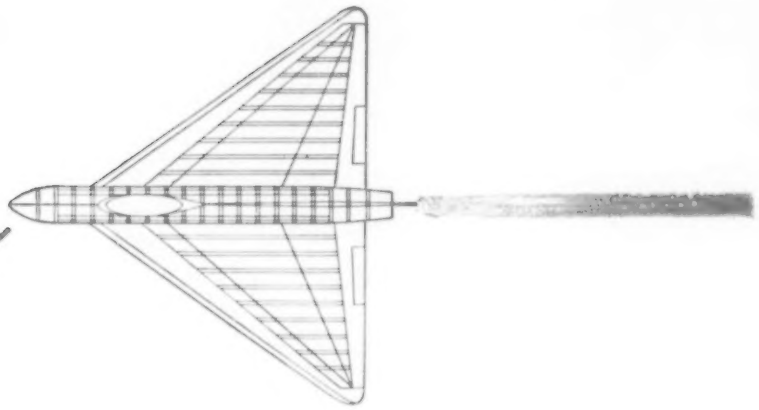
But apparently the public doesn't relish having the remaining 50% of their fun just coming back.

The New York Times reveals "an unexpected and inexplicable development in trans-Atlantic travel has major North Atlantic steamship companies offering accommodations during the peak summer travel season. . . . The 'tremendous' bookings early in the year have tapered off, cancelations have been heavy. . . ."

In the ensuing story, the ship men are quoted on all kinds of theories for this "surprising slump" except one—the airplane.

New York airline circles say they're having no slump. Business is terrific; few cancelations. Maybe the steamship lines are giving fun a bad name.

—Robert H. Wood



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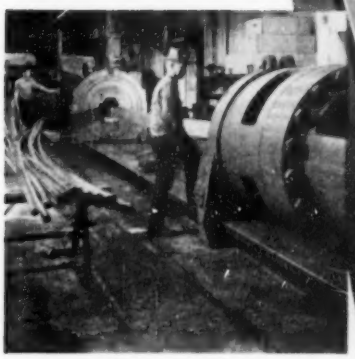

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One plant and one responsibility delivers extruded or combination extruded and pressure forged parts to you more dependably and faster.

Harvey offers industry an integrated facility at one location which shortens the process from idea to finished product. Management, service, engineering, design, die-making and all production operations are closely knit into one efficient team.

Responsibility for accomplishment of the specified stage of finish rests with us up to and including safe delivery at your plant.

Our staff of field engineers is always at your call to arrange the service which best suits your needs.

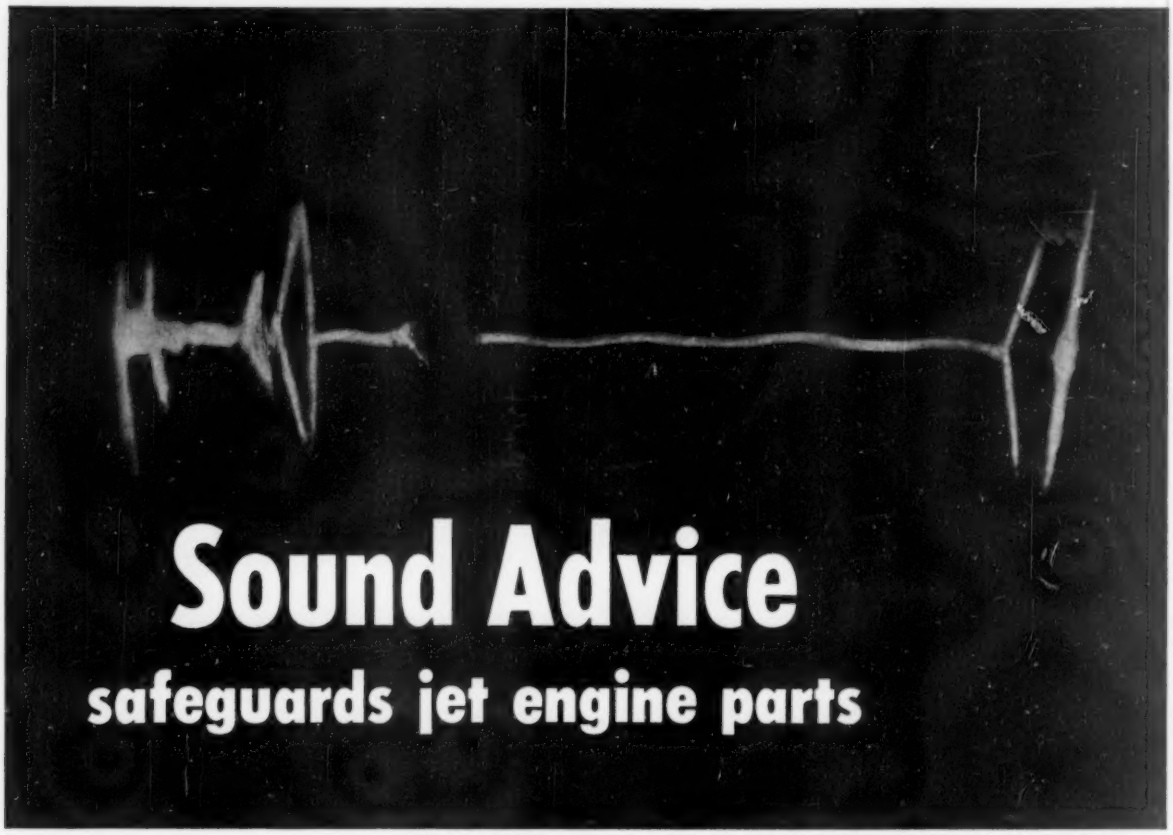
MAKING THE MOST OF ALUMINUM . . . FOR INDUSTRY

HARVEY Aluminum

DIVISION OF HARVEY MACHINE CO., INC.
TORRANCE, CALIFORNIA
BRANCH OFFICES IN PRINCIPAL CITIES

An independent facility producing special extrusions, pressure forgings, bar stock, forging stock, tubing, and related mill products.

ANOTHER REASON ALLISON LEADS IN THE AIR



Sound Advice
safeguards jet engine parts

FINGERS OF SOUND probe metal parts for hidden faults as Allison engineers use the Ultrasonic Reflectoscope

It is important that the metals used in critical jet engine parts be completely free of even the tiniest flaws. To eliminate the possibility of minute defects that even X-ray testing will not reveal, Allison engineers rely on an *ultrasonic reflectoscope* to test parts.

Allison was the first aircraft engine builder to use this unique means to search out subsurface faults. Here's how it operates: High frequency sound waves are sent into the metal part under test, and flaws of a rejectable nature cause "echoes" which are electrically recorded on a screen. This "sound advice" enables Allison to detect hidden imperfections that could not be discovered any other way.

Tests like this are another reason for Allison leadership, because they are typical of the thoroughness that pays off in greater dependability and has won the confidence of jet pilots of many nations.

Several engine pieces, like this J33 compressor, receive 100% Ultrasonic inspection

GM GENERAL MOTORS

Allison

DIVISION OF GENERAL MOTORS
INDIANAPOLIS, INDIANA

World's most experienced designer and builder of aircraft turbine engines—J35 and J71 Axial, J33 Centrifugal Turbo-Jet engines, T38 and T40 Turbo-Prop engines